UNITED STATES DEPARTMENT OF AGRICULTURE
ANIMAL AND PLANT HEALTH INSPECTION SERVICE
WILDLIFE SERVICES

ENVIRONMENTAL ASSESSMENT

Wildlife Damage Management at Baltimore/Washington International Airport, Maryland

Prepared by:

UNITED STATES DEPARTMENT OF AGRICULTURE
ANIMAL AND PLANT HEALTH INSPECTION SERVICE
WILDLIFE SERVICES

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1.0 CHAPTER 1: PURPOSE AND NEED FOR ACTION

1.1 Introduction

The United States Department of Agriculture (USDA) is authorized and directed by law to protect American agriculture and other resources from damage associated with wildlife. The primary statutory authority for the Animal Plant Health Inspection Service (APHIS), Wildlife Services (WS) program is the Act of March 2, 1931, as amended (7 U.S. C. 426-426c; 46 Stat. 1468), the Rural Development, Agriculture, and Related Agencies Appropriations Act of 1988 (P.L. 100-202), and the Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act of 2001 (Public Law 106-387). WS activities are conducted in cooperation with other federal, state and local agencies; and private organizations and individuals. Federal agencies, including the United States Department of Interior (USDI), Fish and Wildlife Service (FWS), recognize the expertise of WS to address wildlife damage issues related to migratory birds.

Wildlife damage management, or control, is defined as the alleviation of damage or other problems caused by or related to the presence of wildlife. It is an integral component of wildlife management (Leopold 1933, the Wildlife Society 1990, Berryman 1991). The WS program uses an Integrated Wildlife Damage Management (IWDM) approach (sometimes referred to as Integrated Pest Management) in which a combination of methods may be used or recommended to reduce wildlife damage. IWDM is described in Chapter 1, 1-7 of The Animal Damage Control (ADC) Program Final Environmental Impact Statement (FEIS) (USDA 1997). These methods include the alteration of cultural practices as well as habitat and behavioral modification to prevent damage. The control of wildlife damage may also require that the offending animal(s) be removed or that populations of the offending species are reduced through lethal methods.

WS's mission is to "provide leadership in wildlife damage management in the protection of America's agricultural, industrial and natural resources, and to safeguard public health and safety." This is accomplished through:

A) Training of wildlife damage management professionals;
B) Development and improvement of strategies to reduce economic losses and threats to humans from wildlife;
C) Collection, evaluation, and dissemination of management information;
D) Cooperative wildlife damage management programs;
E) Informing and educating the public on how to reduce wildlife damage and;
F) Providing data and a source for limited-use management materials and equipment, including pesticides (USDA 1989).

WS is a cooperatively funded and service oriented program. Before any operational wildlife damage management is conducted, WS and the land owner/administrator must complete Agreements for Control or WS Work Plans. WS cooperates with private property owners and managers and with appropriate land and wildlife management agencies, as requested, with the goal of effectively and efficiently resolving wildlife damage problems in compliance with all applicable federal, state, and local laws.

The Maryland Aviation Administration (MAA) has requested WS assistance in reducing wildlife conflicts at Baltimore/Washington International (BWI) Airport, Maryland. This Environmental Assessment (EA) evaluates ways by which this responsibility can be carried out to resolve conflicts with wildlife at BWI airport.

Individual actions on the types of sites encompassed by this analysis may be categorically excluded under the APHIS Implementing Regulations for compliance with the National Environmental Policy Act (NEPA) (7 CFR 372.5(c)). APHIS Implementing Regulations also provide that all technical assistance furnished by WS is categorically excluded (7 CFR 372.5(c)) (60 Federal Register 6,000, 6,003 (1995)). WS has decided to prepare this EA to assist in planning wildlife damage management (WDM) activities and to clearly communicate with the public the analysis of cumulative impacts for a number of issues of concern in

relation to alternative means of meeting needs for such management at BWI airport. This analysis covers WS's plans for current and future WDM actions on BWI airport and adjacent properties. This analysis relies mainly on existing data contained in published documents, primarily the Animal Damage Control Final Environmental Impact Statement (USDA 1997). These WS activities will be undertaken in compliance with relevant laws, regulations, policies, orders, and procedures including the Endangered Species Act (ESA).

1.2 Purpose

The purpose of this EA is to analyze the effects of WS activities on BWI airport to manage damage caused by the mammal and avian wildlife species. Experts within the Federal Aviation Administration (FAA) and the U.S. Department of Agriculture expect the risk, frequency, and potential severity of wildlife-aircraft collisions to escalate over the next decade (Cleary et al. 1999).

Mammals may include, but are not necessarily limited to the following: White-tailed deer (*Odocoileus virginianus*), Coyotes *(Canis latrans),* Red Fox *(Vulpes vulpes),* Gray Fox *(Urocyon cinereoargenteus),* Raccoons *(Procyon lotor),* Opossums *(Didelphis virginianus),* Feral Cats *(Felis sp.),* Feral Dogs *(Canis sp.),* Striped Skunk *(Mephitis mephitis),* Cottontail Rabbits *(Sylvilagus floridanus) and* Woodchucks *(Marmota monax).*

Avian bird species may include, but are not necessarily limited to the following: Red-winged blackbirds *(Agelaius phoeniceus),* European Starlings *(Sturnus vulgaris)*, Brown headed cowbirds *(Molothrus ater)*, Eastern Meadowlarks *(Sturnella magna)*, Horned Larks *(Eremophila alpestris)*, Killdeer *(Charadrius vociferous)*, Canada Geese *(Branta canadensis)*, Mallards *(Anas platyrhynchos),* Other ducks *(Anatidae),* Bonaparte's gull *(Larus philadelphia),* Herring gull *(Larus argentatus),* Laughing gull *(Larus atricilla),* Ring-billed gull *(Larus delawarensis),* Terns *(Sterna sp.),* Great Blue Heron *(Ardea herodias),* Cattle Egret *(Bubulcus ibis),* Great Horned Owl *(Bobo virginianus),* Barred Owl *(Strix varia),* Red-tailed Hawk *(Buteo jamaicensis),* Red-shouldered Hawk *(Buteo lineatus),* Black Vulture *(Coragyps atratus),* Turkey Vulture *(Cathartes aura),* American Kestrel *(Falco sparverius),* Wild Turkey *(Meleagris gallopavo),* Mourning Dove *(Zenaida macroura),* Rock Dove *(Columba livia),* Barn Swallow *(Hirundo rustica),* Tree Swallow *(Tachycineta bicolor),* American Crow *(Corvus brachyrhynchos),* Common Grackle *(Quiscalus quiscula),* Blue Jay *(Cyanocitta cristata),* Northern Cardinal *(Cardinalis cardinalis),* House Sparrow *(Passer domesticus),* Grasshopper sparrow *(Ammodramus savannarum),* Northern Mockingbird *(Mimus polyglottos).*

Resources protected by such activities include property, and human health and safety.

1.3 Need For Action

1.3.1 Summary of Proposed Action

The proposed action is to continue the current WS WDM program to protect property, and human health and safety at BWI airport. An IWDM approach would be implemented which would allow use of any legal technique or method, used singly or in combination, to meet request or needs for resolving conflicts with wildlife affecting the use of the airfield and safe airport operations (Appendix C). Airport personnel requesting assistance would be provided with information regarding the use of effective non-lethal and lethal techniques. Non-lethal methods used or recommended by WS may include habitat alteration, chemical immobilization, repellents, fencing, barriers and deterrents, netting, capture and relocation, and harassment or scaring devices. Lethal methods used or recommended by WS would include shooting, trapping, toxicants, or euthanasia following live capture by trapping. In many situations, the implementation of non-lethal methods such as habitat alteration, structural modifications, and exclusion-type barriers would be the responsibility of the airport to implement. WDM by WS would be allowed on BWI airport and adjacent properties (within 2 miles of airport property), when requested, where a need has been documented and upon completion of an Agreement for Control. All management actions would comply with appropriate federal, state, and local laws.

1.3.2 Objective for the Wildlife Services WDM Program at BWI Airport

The purpose of the proposed action is to minimize the threat to human health and safety and damage to property.

Specific objectives:

- To reduce damaging wildlife strikes at BWI airport to less than 5 strikes per year
- To maintain the runways and airfields to no down time caused by wildlife

1.3.3 Need for Wildlife Damage Management to Protect Property

Wildlife creates a variety of problems at airports that can compromise safe aircraft operations. The most significant are the thousands of collisions that occur annually between wildlife and aircraft (Cleary and Dolbeer 1999). Wildlife strikes result in millions of dollars in direct and indirect damages. Wildlife has adverse impacts on property at airports, such as rodent damage to runway light cables and other electronic safety equipment, bird nests on aircraft and in aircraft engines. The large accumulations of bird droppings associated with nests and roosts causes damage to landscaping, structures, aircraft, vehicles and equipment, and harbor transmissible zoonotic diseases.

Since 1992, BWI Airport recorded more that 350 wildlife strikes; of these 169 had identifiable remains (NWRC – FAA Strike Database 2002). BWI experienced strikes from gulls (19%), white-tailed deer (3.6%), other mammals (2.2%), raptors (3.6%) waterfowl (3%) and other birds (14.9%) that include blackbirds, starlings, pigeons, doves, sparrows, crows, and swallows. This number is likely to be much greater since an estimated 80% of civil bird strikes go unreported (Bird Strike Committee USA 2000).

1.3.3.1 Need for Bird Damage Management to Protect Property

Birds are a continuous threat to aircraft for the simple fact that they are highly mobile and often prefer the habitat created by an airfield. With this in mind and following the basic laws of physics that no two items can occupy the same space at the same time, a pro-active management should be taken in order to reduce these threats. One such incident took place in November 1998, a Boeing-737 was taking off from BWI airport and flew into a flock of Canada Geese. After ingesting a goose into one engine, the pilot was forced to shut the engine down and make an emergency landing at BWI. Fortunately, no one was injured, but the engine was replaced and over 100 passengers had to be rebooked on other flights.

Birds occasionally damage structures with fecal contamination. Accumulated bird droppings can reduce the functional life of some building roofs by 50% (Weber 1979). Corrosion damage to metal structures and painted finishes, including those on aircraft and automobiles parked at terminals, can occur because of uric acid from bird droppings. Pigeons, starlings and house sparrows sometimes cause structural damage to the inside of hangers and buildings. These birds often roost or nest in the rafters of the buildings where they damage the insulation, and wiring. Also, birds build their nest in engines and other compartments of parked aircraft.

1.3.3.2 Need for Mammal Damage Management to Protect Property

Mammals also pose a serious threat to aircraft. Deer, foxes, raccoons and woodchucks venture onto airfields and become a direct threat to planes both landing and taking off. Since 1985 the USAF has recorded more that 190 strikes that involved aircraft and mammals (Cleary and Dolbeer 1999). These strikes resulted in more than $496,000 in damage. Of these strikes, deer are the most costly to aircraft, with the most recent occurring at Laughlin AFB in March of 2000. A T-38 Talon hit a deer on landing and caused damage to the left main landing gear (BASH 2000). Also at Little Rock AFB, between 1993 and 1998 three deer strikes were recorded (BASH 2000). These strikes averaged over $4600 per strike. BWI airport also experienced a similar mammal strike. In October 1995 a US Airways Boeing-737 struck a deer during a landing roll. Damage was done to the hydraulics of the

aircraft, which resulted in the closing of two runways for over an hour and 7 aircraft diverted causing significant delays in departures and arrivals. (NWRC- FAA Strike Database 2002). WS has been working at BWI airport to reduce threats through technical assistance and direct control. Such activities include the recommendation to modify habitat and use of harassment techniques.

1.3.4 Need for Wildlife Damage Management to Protect Human Health and Safety

Wildlife poses risks to human health and safety when their populations reach relatively high numbers or when concentrated in a localized area. These risks include but are not limited to items such as transmission of diseases, injury or death to persons involved in wildlife/aircraft strikes and injury from aggressive behavior of wildlife. The risk that wildlife pose to aircraft is well documented with the worst case reported in Boston in 1960 when 62 people were killed in the crash of an airliner which collided with a flock of starlings (Terres 1980). Fortunately at BWI, wildlife strikes have not yet resulted in catastrophic accidents involving the loss of human life, but the potential is real; such accidents have occurred in the past and are occurring with increasing frequency nationwide (Cleary and Dolbeer 1999).

1.3.4.1 Bird Damage Management to Protect Human Health and Safety

Bird/aircraft strikes occur when birds occupy the same space as aircraft. The risk of injury is great in these incidents and the loss of life has happened many times (Cleary and Dolbeer 1999). An example where pro-active management would have saved lives was in September 1995, an USAF AWAC aircraft crashed immediately after take-off at Elmendorf Air Force Base, Alaska, killing all 24 personnel on board (USDA 1998). The plane struck a flock of Canada geese that had been seen on a field adjacent to the airfield by a controller, unfortunately the E-3 crew or the Airfield management was not notified. At BWI airport, these threats come in many shapes and sizes. Resident Canada geese often use the grass fields for loafing, feeding and nesting areas. Many airports have had problems with blackbirds (red-winged blackbirds, European starlings, grackles, brown-headed cowbirds, etc.) that have established roosts and staging areas on or near the airfield. These large flocks of birds pose such a risk to aircraft and the health and safety of pilots that a NOTAM is in effect year round. WS has been requested to resolve problems such as the removal of birds from inside buildings and hangars, in common areas where people work or congregate, and from the airfield. Examples include the removal of starlings from hangers and around loading bridges and geese that were feeding adjacent to an active runway. Another issue of concern that WS has been asked to address is wild bird's carrying/transmitting West Nile Virus.

In addition to the threats to aircraft safety, BWI airport has requested assistance with the management of starlings nesting in and around the main terminal building and loading bridges. The problems associated with these roosts create disease risks, plus the mess associated with droppings left by concentrations of birds is aesthetically displeasing and results in continual clean-up costs. Feral domestic pigeons and starlings have been suspected in the transmission of 65 different diseases to humans (Rid-A-Bird 1978, Weber 1979, and Davis et.al. 1971). These include viral diseases such as meningitis and seven different forms of encephalitis; bacterial diseases such as erysipeloid, salmonellosis, paratyphoid, pasteurellosis, and listeriosis; mycotic (fungal) diseases such as aspergillosis, blastomycosis, candidiasis, cryptococcosis, histoplasmosis, and sarcosporidiosis; protozoal diseases such as American trypansomiasis and toxoplasmosis; and rickettsial/chlamydial diseases such as chlamydiosis and Q fever. Appendix D shows the more typical diseases affecting humans that can be transmitted by pigeons, starlings, and sparrows.

1.3.4.2 Mammal Damage Management to Protect Human Health and Safety

WS is often contacted and asked to solve problems involving mammal damage issues in relation to human safety. At many airports there is the continuing risk of a mammal/aircraft strike which could result in human injury or death (Cleary and Dolbeer 1999). WS has been requested to resolve problems such as deer that have wandered onto the airfield; and foxes that have crossed runways and taxiways while foraging. Another issue of concern that WS has been asked to address is wild mammal's carrying/transmitting rabies or other zoonotic diseases.

1.4 Current and Projected Work

A variety of services have been and are currently being provided by WS to reduce wildlife hazards at BWI airport. These services include technical assistance, wildlife hazard assessments, wildlife hazard management plans, and direct assistance. Direct assistance services currently involve one full time WS wildlife biologist to implement the airport's wildlife hazard management plan. Projected services at BWI airport include conducting annual wildlife hazard assessments, developing a wildlife hazard management plan, providing technical assistance, and conducting direct control services. Examples of different work that has been conducted are: facilitating required federal and state permits, recommendations to modify habitat through vegetation management programs, providing recommendations for proper wildlife fences, landscape and architectural consulting, providing training to airport personnel, and direct control activities. Direct control activities include but are not limited to various techniques of non-lethal harassment and lethal removal.

1.5 Relationship of the Environmental Assessment to other Environmental Documents

Wildlife Services Programmatic EIS. WS has issued a Final Environmental Impact Statement (FEIS) on the national APHIS/WS program (USDA 1997). Pertinent information available in the FEIS has been incorporated by reference into this EA.

EA and Finding of No Significant Impact – Proposed Maryland Aviation Administration Development at Baltimore / Washington International Airport. This EA and its FONSI completed by the FAA in 2000 analyzed the environmental effects associated with the construction of facilities at BWI airport including the potential wildlife hazards resulting from the project. Pertinent information from this analysis has been incorporated by reference into this EA.

1.6 Decision to be Made

Based on the scope of this EA, the decisions to be made are:

- Should the IWDM strategy implemented by the WS program be continued at BWI airport?
- If not, should WS attempt to implement any of the alternatives to an IWDM strategy as described in the EA?
- Might the implementation of a WS's program of WDM have significant impacts requiring preparation of an EIS?

1.7 Scope Of This Environmental Assessment Analysis

1.7.1 Actions Analyzed This EA evaluates wildlife damage management by WS to protect property, and human health and safety on BWI Airport, Maryland

1.7.2 Period for Which this EA is Valid This EA will remain valid until WS determines that new needs for action or new alternatives having different environmental effects must be analyzed. At that time, this analysis and document will be reviewed and revised as necessary. This EA will be reviewed each year to ensure that it is complete and still appropriate to the scope of WS's WDM activities.

1.7.3 Site Specificity. This EA analyzes potential impacts of WS's WDM activities that will occur or could occur on BWI Airport, Maryland and adjacent properties. Adjacent properties include all public and private lands and waters within a 2 mile radius of BWI airport property. This EA analyzes the potential impacts of such efforts wherever and whenever they might occur. The EA emphasizes significant issues as they relate to specific areas whenever possible. However, the issues that pertain to the various types of wildlife damage and resulting management are the same, for the most part, wherever they occur, and are treated as such. The standard WS Decision Model (Slate et al. 1992) and WS Directive 2.105 is the routine thought process that is the site-specific procedure for determining methods and strategies to use or recommend for individual actions conducted by WS (See USDA 1997, Chapter 2 and Appendix N for a

more complete description of the WS Decision Model and examples of its application). Decisions made using this thought process will be in accordance with any mitigation measures and standard operating procedures described herein and adopted or established as part of the decision.

1.7.4 Public Involvement/Notification. As part of this process, and as required by the Council on Environmental Quality (CEQ) and APHIS-NEPA implementing regulations, this document and its Decision are being made available to the public through "Notices of Availability" (NOA) published in local media and through direct mailings of NOA to parties that have specifically requested to be notified. New issues or alternatives raised after publication of public notices will be fully considered to determine whether the EA and its Decision should be revisited and, if appropriate, revised.

1.8 Authority and Compliance

1.8.1 Authority of Federal and State Agencies in Wildlife Damage Management on BWI airport.

1.8.1.1 WS Legislative Authority

The primary statutory authority for the WS program is the Act of 1931, as amended in the Fiscal Year 2001 Agriculture Appropriations Bill, which provides that:

"The Secretary of Agriculture may conduct a program of wildlife services with respect to injurious animal species and take any action the Secretary considers necessary in conducting the program. The Secretary shall administer the program in a manner consistent with all of the wildlife services authorities in effect on the day before the date of the enactment of the Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2001."

Since 1931, with the changes in societal values, WS policies and programs place greater emphasis on the part of the Act discussing "bringing (damage) under control," rather than "eradication" and "suppression" of wildlife populations. In 1988, Congress strengthened the legislative mandate of WS with the Rural Development, Agriculture, and Related Agencies Appropriations Act. This Act states, in part:

"That hereafter, the Secretary of Agriculture is authorized, except for urban rodent control, to conduct activities and to enter into agreements with States, local jurisdictions, individuals, and public and private agencies, organizations, and institutions in the control of nuisance mammals and birds and those mammal and bird species that are reservoirs for zoonotic diseases, and to deposit any money collected under any such agreement into the appropriation accounts that incur the costs to be available immediately and to remain available until expended for Animal Damage Control activities."

1.8.1.2 U.S. Fish and Wildlife Service (USFWS)

The USFWS is responsible for managing and regulating take of bird species that are listed as migratory under the Migratory Bird Treaty Act (MBTA) and those that are listed as threatened or endangered under the Endangered Species Act (ESA). Sections 1.8.2.2 and 1.8.2.3 below describe WS's interactions with the USFWS under these two laws.

1.8.1.3 Maryland Department of Natural Resources Legislative Authority

The Maryland Department of Natural Resources (MDNR), under the direction of the Wildlife Advisory Commission, is specifically charged by the General Assembly with the management of the state's wildlife resources. The primary statutory authorities include the protection, reproduction, care, management, survival, and regulation of wild animal populations regardless of whether the wild animals are present on public or private property in Maryland (COMAR 2-10-202-210). The MDNR Wildlife and Heritage Service shall administer this article.

1.8.1.4 Maryland Department of Agriculture

The Pesticide Regulation Section administers Maryland's Pesticide Applicator's Law, sponsors training courses in the handling, storage and use of pesticides, conducts examinations to determine that pesticide applicators are competent to follow prescribed pest control practices, enforces federal laws on the sale and use of pesticides, and investigates pesticide accidents or incidents and consumer complaints on pesticide misuse.

1.8.2 Compliance with other Federal Laws

Several other federal laws authorize, regulate, or otherwise affect WS wildlife damage management. WS complies with these laws, and consults and cooperates with other agencies as appropriate.

1.8.2.1 National Environmental Policy Act (NEPA)

The National Environmental Policy Act (NEPA) of 1969 (42 USC Section 4231 et seq.) is implemented by Federal Agencies pursuant to Council on Environmental Quality (CEQ) Regulations (40 CFR Section 1500-1508) and agency implementing regulations. WS prepares analyses of the potential environmental impacts of program activities to meet procedural requirements of NEPA and to facilitate planning, decision-making, and public and interagency involvement. Environmental documents pursuant to NEPA must be completed before work plans consistent with the NEPA decision can be implemented. WS also coordinates specific projects and programs with other agencies. The purpose of these contacts is to coordinate any wildlife damage management that may affect resources managed by these agencies or affect other areas of mutual concern. This EA meets the NEPA requirement for the proposed action at BWI airport.

1.8.2.2 Endangered Species Act (ESA)

It is federal policy, under the ESA, that all federal agencies shall seek to conserve threatened and endangered (T&E) species and shall utilize their authorities in furtherance of the purposes of the Act (Sec.2(c)). WS conducts Section 7 consultations with the USFWS to use the expertise of the USFWS to ensure that "any action authorized, funded or carried out by such an agency . . . is not likely to jeopardize the continued existence of any endangered or threatened species . . . Each agency shall use the best scientific and commercial data available" (Sec.7(a)(2)). WS obtained a Biological Opinion (B.O.) from USFWS in 1992 describing potential effects on T&E species and prescribing reasonable and prudent measures for avoiding jeopardy (USDA 1997, Appendix F).

1.8.2.3 Migratory Bird Treaty Act of 1918 (16 U.S.C. 703-711; 40 Stat. 755), as amended.

The MBTA provides the USFWS regulatory authority to protect families of birds that contain species that migrate outside the United States. The law prohibits any "take" of these species, except as permitted by the USFWS; therefore the USFWS issues permits for reducing bird damage. WS will obtain MBTA permits covering WDM activities that involve the taking of species for which such permits are required in accordance with the MBTA and USFWS regulations, or will operate as a named agent on MBTA permits obtained by cooperators.

1.8.2.4 Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)

FIFRA requires the registration, classification, and regulation of all pesticides used in the United States. The Environmental Protection Agency (EPA) is responsible for implementing and enforcing FIFRA. All chemical methods used or recommended by the WS program at BWI airport are registered with and regulated by the EPA and the Maryland Department of Agriculture (MDA), and are used by WS in compliance with labeling procedures and requirements.

1.8.2.5 National Historic Preservation Act (NHPA) of 1966 as amended

The National Historic Preservation Act (NHPA) of 1966, and its implementing regulations (36 CFR 800), requires federal agencies to: 1) determine whether activities they propose constitute "undertakings" that can result in changes in the character or use of historic properties and, 2) if so, to evaluate the effects of such undertakings on such historic resources and consult with the State Historic Preservation Office regarding the value and management of specific cultural, archaeological and historic resources, and 3) consult with appropriate American Indian Tribes to determine whether they have concerns for traditional cultural properties in areas of these federal undertakings. WS activities as described under the proposed action do not cause ground disturbances nor do they otherwise have the potential to significantly affect visual, audible, or atmospheric elements of historic properties and are thus not undertakings as defined by the NHPA. WS has determined WDM actions are not undertakings as defined by the NHPA because such actions do not have the potential to result in changes in the character or use of historic properties.

1.8.2.6 Federal Food, Drug, and Cosmetic Act (21 U.S.C. 360). This law places administration of pharmaceutical drugs, including those used in wildlife capture and handling, under the Food and Drug Administration.

1.8.2.7 Environmental Justice and Executive Order 12898 - "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations."

Executive Order 12898, entitled, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations" promotes the fair treatment of people of all races, income levels and cultures with respect to the development, implementation and enforcement of environmental laws, regulations and policies. Environmental justice is the pursuit of equal justice and protection under the law for all environmental statutes and regulations without discrimination based on race, ethnicity, or socioeconomic status and is a priority within APHIS and WS. Executive Order 12898 requires Federal agencies to make environmental justice part of their mission, and to identify and address disproportionately high and adverse human health and environmental effects of Federal programs, policies and activities on minority and low-income persons or populations. APHIS implements Executive Order 12898 principally through its compliance with NEPA. All WS activities are evaluated for their impact on the human environment and compliance with Executive Order 12898. WS personnel use only legal, effective, and environmentally safe wildlife damage management methods, tools, and approaches. It is not anticipated that the proposed action would result in any adverse or disproportionate environmental impacts to minority and low-income persons or populations.

1.8.2.8 Protection of Children from Environmental Health and Safety Risks (Executive Order 13045)

Children may suffer disproportionately from environmental health and safety risks for many reasons. Wildlife damage management as proposed in this EA would only involve legally available and approved damage management methods in situations or under circumstances where it is highly unlikely that children would be adversely affected. Therefore, implementation of the proposed action would not increase environmental health or safety risks to children.

1.8.2.9 Executive Order 13112 - Invasive Species

Executive Order 13112 directs Federal agencies to use their programs and authorities to prevent the spread or to control populations of invasive species that cause economic or environmental harm, or harm to human health. Pigeons, starlings, and English sparrows are recognized as invasive species that have adverse economic, ecological, and human health impacts.

1.8.2.10 Occupational Safety and Health Act of 1970.

The Occupational Safety and Health Act of 1970 and its implementing regulations (29CFR1910) on sanitation standards states that “Every enclosed workplace shall be so constructed, equipped, and maintained, so far as reasonably practical, as to prevent the entrance or harborage of rodents, insects, and

other vermin. A continuing and effective extermination program shall be instituted where their presence is detected." This standard includes birds that may cause safety and health concerns at workplaces.

1.8.2.11 Executive Order 13186 – Responsibilities of Federal Agencies to Protect Migratory Birds

Executive Order 13186 requires each Federal agency taking actions that have, or are likely to have, a measurable negative effect on migratory bird populations, is directed to develop and implement, a Memorandum of Understanding (MOU) with the USFWS that shall promote the conservation of migratory bird populations. WS has developed a draft MOU with the USFWS as required by this EO and is currently waiting for USFWS approval. WS will abide by the MOU once it is finalized and signed by both parties.

1.8.12 The Native American Graves and Repatriation Act of 1990

The Native American Graves Protection and Repatriation Act require Federal agencies to notify the Secretary of the Department that manages the Federal lands upon the discovery of Native American cultural items on Federal or tribal lands. Federal projects would discontinue work until a reasonable effort has been made to protect the items and the proper authority has been notified.

1.8.13 The Clean Water Act (33 U.S.C. 1344)

The Clean Water Act provides regulatory authority and guidelines for the EPA and the U.S. Army Corps of Engineers related to wetlands. Several Sections of the Clean Water Act pertain to regulating effects to wetlands. Section 101 specifies the objectives of this Act, which are implemented largely through Subchapter III (Standards and Enforcement), Section 301 (Prohibitions). The discharge of dredged or fill material into waters of the United States is subject to permitting specified under Subchapter IV (Permits and Licenses) of this Act. Section 401 (Certification) specifies additional requirements for permit review particularly at the State level. WS consults with appropriate regulatory authorities when wetlands exist in proximity to proposed activities or when such activities might impact wetland areas. Such consultations are designed to determine if any wetlands will be affected by proposed actions.

1.8.3 Compliance with other State Laws

1.8.3.1 Department may reduce wildlife in identifiable areas COMAR 2-10-206

The Maryland DNR is the state agency responsible for managing the wildlife resources of the State and has authority to reduce wildlife populations in any county, election district, or other identifiable area of the State, when thorough investigation reveals that such populations are seriously injurious to agricultural or other interests in the affected area (Annotated Code of Maryland, 10-206). The control of wildlife on private property by DNR and other state or federal agencies is done only in extreme circumstances (e.g., disease control) and is done with landowner permission. The control of wildlife in any area of the state must be supported by documentation of the need for control and is subject to federal regulations from migratory birds.

2.0 CHAPTER 2 - ISSUES

Chapter 2 contains a discussion of the issues, including issues that will receive detailed environmental impacts analysis in Chapter 4 (Environmental Consequences), issues that have driven the development of mitigation measures and/or standard operating procedures, and issues that will not be considered in detail, with rationale. Pertinent portions of the affected environment will be included in this chapter in the discussion of issues used to develop mitigation measures. Additional description of affected environments will be incorporated into the discussion of the environmental impacts in Chapter 4.

Affected Environment

The affected area includes Baltimore/Washington International Airport within the perimeter fence and adjacent properties. Adjacent properties include all public and private lands and waters within a 2 mile radius of BWI airport property. BWI Airport and areas within the critical zone (approx.2 miles) contain types of habitat such as woodlands, wetlands, grasslands, and suburban areas. Airport properties include the AOA and usually some leased properties, which may involve commercial, natural resources, and residential areas. Potentially WS could be called upon to conduct WDM on BWI Airport including any adjacent properties that are negatively impacting or have the potential to negatively impact airport operations. Any adjacent properties not under airport authority would be dealt with under a separate agreement.

2.1 Issues. The following issues have been identified as areas of concern requiring consideration in this EA. These will be analyzed in detail in Chapter 4:

- Effects on Target Wildlife Species Populations
- Effects on Other Wildlife Species Populations, including T&E Species
- Economic Losses to Property as a Result of Wildlife Damage
- Effects on Human Health and Safety
- Effects on Aesthetics
- Humaneness and Animal Welfare Concerns of Lethal Methods Used by WS

2.2 Issues Addressed in the Analysis of Alternatives

2.2.1 Effects on Target Wildlife Species Populations

A common concern among members of the public is whether wildlife damage management actions adversely affect the viability of target species populations. The target species selected for analysis in this EA are the mammal and bird species listed in section 1.2. A minimal number of individuals are likely to be killed by WS's use of lethal control methods under the proposed action in any one year.

Impacts of West Nile Virus on bird populations

West Nile (WN) virus has emerged in recent years in temperate regions of North America, with the first appearance of the virus in North America occurring in New York City in 1999 (MMWR 2002, Rappole et al. 2000). Since 1999 the virus has spread across the United States and was reported to occur in 44 states and the District of Columbia in 2002 (MMWR 2002). West Nile Virus is typically transmitted between birds and mosquitoes. Mammals can become infected if bitten by an infected mosquito, but individuals in most species of mammals do not become ill from the virus. The most serious manifestation of the WN virus is fatal encephalitis in humans, horses, and birds. WN virus has been detected in dead bird species of at least 138 species (CDC 2003). Although birds infected with WN virus can die or become ill, most infected birds do survive and may subsequently develop immunity to the virus (CDC 2003, Cornell University 2003). In some bird species, particularly Corvids (crows, blue jays, ravens, magpies), the virus causes disease (often fatal) in a large percentage of infected birds (Audubon 2003, CDC 2003, Cornell University 2003, MMWR 2002). In 2002, WN virus surveillance/monitoring programs revealed that Corvids accounted for 90% of the dead birds reported with crows representing the highest rate of infection (MMWR 2002). Large birds that live and die near humans (i.e. crows) have a greater likelihood of being

discovered, therefore the reporting rates tend to be higher for these bird species and are a "good indicator" species for the presence of WN virus in a specific area (Cornell University 2003, Audubon 2003). According to US Geological Survey (USGS), National Wildlife Health Center (2003), information is not currently available to know whether or not WN virus is having an impact on bird populations in North America. USGS states that it is not unusual for a new disease to cause high rates of infection or death because birds do not have a natural immunity to the infection. Furthermore, it is now known how long it will take for specific bird population to develop sufficient immunity to the virus. Surveys of wild birds completed in the last three years have shown that some birds have already acquired antibodies to the virus (USGS-WHC 2003). Based upon available Christmas Bird Counts and Breeding Bird Surveys, USGS, WHC (2003) states that there have been declines in observations of many local bird populations, however, they do not know if the decline can be attributed to WN virus or some other cause. A review of available crow population data by Audubon (2003) reveals that at least some local crow populations are suffering high WN virus related mortality, but crow numbers do not appear to be declining drastically across broad geographic areas. USGS does not anticipate that the commonly seen species, such as crows and blue jays, will be adversely affected by the virus to the point that these bird species will disappear from the U.S. (USGS-WHC 2003).

2.2.2 Effects on Other Wildlife Species populations, including T&E Species

A common concern among members of the public and wildlife professionals, including WS personnel, is the impact of damage control methods and activities on non-target species, particularly T&E species. WS's Standard Operating Procedures (SOP's) include measures intended to mitigate or reduce the effects on non-target species populations and are presented in Chapter 3.

Special efforts are made to avoid jeopardizing T&E species through biological evaluations of the potential effects and the establishment of special restrictions or mitigation measures. WS has consulted with the USFWS under Section 7 of the ESA concerning potential impacts of WDM methods on T&E species and has obtained a Biological Opinion (B.O.). For the full context of the B.O., see Appendix F of the ADC FEIS (USDA 1997, Appendix F). WS is also in the process of reinitiating Section 7 consultation at the program level to assure that potential effects on T&E species have been adequately addressed.

2.2.3 Economic Losses to Property as a Result of Wildlife Damage

A major concern of the airport industry is the economic impact of wildlife damage to aircraft and other property. These people are concerned as to whether the proposed action or any of the alternatives would reduce such damage to more acceptable levels. Wildlife has and could cause damage to aircraft and property as describe in the need for action.

2.2.4 Effects on Human Health and Safety

2.2.4.1 Safety and efficacy of chemical control methods

Some individuals may have concerns that chemicals used for animal control should not be used because of potential adverse effects on people from being exposed to the chemicals directly or to the animals that have died as a result of the chemical use. Under the alternatives proposed in this EA, one of the toxicants proposed for use by WS is DRC-1339 (Starlicide), which would be primarily used to remove feral domestic pigeons, European starlings, or blackbirds in damage situations. The EPA through FIFRA regulates DRC-1339 use, by Maryland Pesticide Control Laws, and by WS Directives. The chemical bird repellents methyl anthranilate (Rejex-it®, Goose Chase®, etc.) or anthraquinone (Flight Control®) could be used to reduce feeding activity on the airfield. Both methyl anthranilate and anthraquinone are non-lethal and work by causing a negative response to feeding in the treated area. Another chemical method that could be used is Avitrol®, which is classified as a chemical frightening agent and is normally used to avert certain bird species from using certain problem areas. The avian tranquilizer Alpha-Chloralose could be used for live-capturing nuisance waterfowl.

In some situations, a chemical control alternative may be considered for managing nuisance mammals. Under the alternatives proposed in this EA, registered rodenticides could be used to manage damaging populations of rodents in both field and structural environments. These rodenticides fall into two basic categories: 1) anticoagulants; 2) non-anticoagulants (such as Bromethalin, Cholecalciferol, and zinc phosphide). The chemical repellents: fatty acids, putrescent egg solids, capsaicin, denatonium saccharide, and thiram may be used to reduce feeding activity or structural damage on the airfield.

2.2.4.2 Impacts on human safety of non-chemical WDM methods

Some people may be concerned that WS's use of firearms, traps, snare, and pyrotechnic scaring devices could cause injuries to people. WS personnel occasionally use traps, snares, rifles and shotguns to remove wildlife that are causing damage.

2.2.4.3 Impacts on human safety from wildlife strike hazards

A common concern among members of the public and the airline industry is that the absence of adequate WDM would result in adverse effects on human health and safety, because bird and mammal strikes on aircraft would not be curtailed or reduced to the minimum levels possible and practical. The potential impacts of not conducting such work could lead to increased incidence of injuries or loss of human lives from wildlife strikes to aircraft.

2.2.5 Effects on Aesthetics

2.2.5.1 Effects on Human Affectionate-Bonds with Individual animals and on Aesthetic Values of Wildlife Species

The human attraction to animals has been well documented throughout history and started when humans began domesticating animals. The American public is no exception and today a large percentage of households have pets. However, some people may consider individual wild animals and birds as “pets” or exhibit affection toward these animals, especially people who enjoy coming in contact with wildlife. Therefore, the public reaction is variable and mixed to wildlife damage management because there are numerous philosophical, aesthetic, and personal attitudes, values, and opinions about the best ways to manage conflicts/problems between humans and wildlife.

Some individual members or groups of wildlife species habituate and learn to live in close proximity to humans. Some people in these situations feed such birds/mammals and/or otherwise develop emotional attitudes toward such animals that result in aesthetic enjoyment. In addition, some people consider individual wild animals as "pets," or exhibit affection toward these animals. Examples would be people who visit a city park to feed waterfowl or pigeons and homeowners who have bird feeders or birdhouses. Many people do not develop emotional bonds with individual wild animals, but experience aesthetic enjoyment from observing them.

There is some concern that the proposed action or the alternatives would result in the loss of aesthetic benefits to the public, resource owners, or neighboring residents. Wildlife generally is regarded as providing economic, recreational, and aesthetic benefits (Decker and Goff 1987), and the mere knowledge that wildlife exists is a positive benefit to many people. Aesthetics is the philosophy dealing with the nature of beauty, or the appreciation of beauty. Therefore, aesthetics are truly subjective in nature, dependent on what an observer regards as beautiful.

Wildlife populations provide a range of social and economic benefits (Decker and Goff 1987). These include direct benefits related to consumptive and non-consumptive use (e.g., wildlife-related recreation, observation, harvest, sale), indirect benefits derived from vicarious wildlife related experiences (e.g., reading, television viewing), and the personal enjoyment of knowing

wildlife exists and contributes to the stability of natural ecosystems (e.g., ecological, existence, bequest values) (Bishop 1987). Direct benefits are derived from a user's personal relationship to animals and may take the form of direct consumptive use (using up the animal or intending to) or non-consumptive use (viewing the animal in nature or in a zoo, photography) (Decker and Goff 1987). Indirect benefits or indirect exercised values arise without the user being in direct contact with the animal and come from experiences such as looking at photographs and films of wildlife, reading about wildlife, or benefiting from activities or contributions of animals such as their use in research (Decker and Goff 1987). Indirect benefits come in two forms: bequest and pure existence (Decker and Goff 1987). Bequest is providing for future generations and pure existence is merely knowledge that the animals exist (Decker and Goff 1987).

Public reaction to damage management actions is variable because individual members of the public can have widely different attitudes toward wildlife. Some individuals that are negatively affected by wildlife support removal or relocation of damaging wildlife. Other individuals affected by the same wildlife may oppose removal or relocation. Individuals unaffected by wildlife damage may be supportive, neutral, or opposed to wildlife removal depending on their individual personal views and attitudes.

The public's ability to view wildlife in a particular area would be more limited if the birds and mammals are removed or relocated. However, immigration of wildlife from other areas could possibly replace the animals removed or relocated during a damage management action. In addition, the opportunity to view or feed other wildlife would be available if an individual makes the effort to visit local wildlife management areas and other sites with adequate habitat and local populations of the species of interest.

Some people do not believe that individual animals or nuisance bird roosts should even be harassed to stop or reduce damage problems. Some of them are concerned that their ability to view birds and other wildlife species are lessened by WS non-lethal harassment efforts.

WS recognizes that all wildlife has aesthetic value and benefit. WS only conducts wildlife damage management at the request of the affected property owner or resource manager. If WS received requests from an individual or official for wildlife damage management, WS would address the issues/concerns and consideration would be made to explain the reasons why the individual damage management actions would be necessary. Management actions would be carried out in a caring, humane, and professional manner.

2.2.5.2 Effects on Aesthetic Values of Property Damaged by Birds

Airport personnel have expressed concerns of bird roosting in trees, shrubs, walkways, and structures. They are generally concerned about the negative aesthetic appearance, mess, and odor associated with bird droppings.

2.2.6 Humaneness and Animal Welfare Concerns of Lethal Methods Used by WS.

The issue of humaneness and animal welfare, as it relates to the killing or capturing of wildlife is an important but very complex concept that can be interpreted in a variety of ways. Schmidt (1989) indicated that vertebrate pest damage management for societal benefits could be compatible with animal welfare concerns, if " . . . the reduction of pain, suffering, and unnecessary death is incorporated in the decision making process."

Suffering is described as a " . . . highly unpleasant emotional response usually associated with pain and distress." However, suffering " . . . can occur without pain . . ." and " . . . pain can occur without suffering . . . " (AVMA 1987). Because suffering carries with it the implication of a time frame, a case could be made for " . . . little or no suffering where death comes immediately . . . " (CDFG 1991), such as shooting.

Defining pain as a component in humaneness of WS methods appears to be a greater challenge than that of suffering. Pain obviously occurs in animals. Altered physiology and behavior can be indicators of pain, and identifying the causes that elicit pain responses in humans would " . . . probably be causes for pain in other animals . . . " (AVMA 1987). However, pain experienced by individual animals probably ranges from little or no pain to significant pain (CDFG 1991).

Pain and suffering, as it relates to WS damage management methods, has both a professional and lay point of arbitration. Wildlife managers and the public would be better served to recognize the complexity of defining suffering, since " . . . neither medical or veterinary curricula explicitly address suffering or its relief" (CDFG 1991).

Therefore, humaneness, in part, appears to be a person's perception of harm or pain inflicted on an animal, and people may perceive the humaneness of an action differently. The challenge in coping with this issue is how to achieve the least amount of animal suffering within the constraints imposed by current technology and funding.

WS has improved the selectivity and humaneness of management techniques through research and development. Research is continuing to bring new findings and products into practical use. Until new findings and products are found practical, a certain amount of animal suffering could occur when some lethal WDM methods are used in situations where non-lethal damage management methods are not practical or effective.

WS personnel are experienced and professional in their use of management methods so that they are as humane as possible under the constraints of current technology, workforce and funding. Mitigation measures and SOP's used to maximize humaneness are listed in Chapter 3.

2.3 Issues Considered But Not in Detail with Rationale

2.3.1 WS's Effect on Biodiversity

The WS program does not attempt to eradicate any species of wildlife in Maryland. WS operates in accordance with international, Federal and State laws, and regulations enacted to ensure species viability. Effects on target and nontarget species populations because of WS's lethal WDM activities are minor, as shown in Section 4.1.1 and 4.1.2. The effects of the current WS program on biodiversity are not significant nationwide or statewide (USDA 1997).

3.0 CHAPTER 3: ALTERNATIVES INCLUDING THE PROPOSED ACTION

This chapter consists of 6 parts: 1) an introduction, 2) description of alternatives considered and analyzed in detail including the Proposed Action/No Action (Alternative 1), 3) a description of IWDM, 4) wildlife damage management methods available for use or recommendation by WS, 5) alternatives considered but not in detail, with rationale, and 6) mitigation measures and SOPs for WDM.

Alternatives were developed for consideration using the WS Decision Model (Slate et al. 1992), *"Methods of Control*" (USDA 1997 Appendix J) and the *"Risk Assessment of Wildlife Damage Control Methods Used by the USDA Animal Damage Control Program"* (USDA 1997, Appendix P) of USDA (1997).

Alternatives analyzed in detail are:

Alternative 1 – WS Integrated WDM program. This is the Proposed Action and No Action alternative.
Alternative 2 – WS non-lethal WDM program only.
Alternative 3 – WS lethal WDM program only.
Alternative 4 - No WS WDM program.

3.1 DESCRIPTION OF THE ALTERNATIVES

3.1.1 Alternative 1 – WS Integrated WDM program (Proposed Action/No Action).

The proposed action is to continue the current WS WDM program to protect property, and human health and safety at BWI airport. An IWDM approach would be implemented which would allow use of any legal technique or method, used singly or in combination, to meet request or needs for resolving conflicts with wildlife affecting the use of the airfield and safe airport operations (Appendix C). Airport personnel requesting assistance would be provided with information regarding the use of effective non-lethal and lethal techniques. Lethal methods used or recommended by WS would include shooting, trapping, toxicants, or euthanasia following live capture by trapping. Non-lethal methods used or recommended by WS may include habitat alteration, chemical immobilization, repellents, fencing, barriers and deterrents, netting, capture and relocation, and harassment or scaring devices. In many situations, the implementation of non-lethal methods such as habitat alteration, structural modifications, and exclusion-type barriers would be the responsibility of the airport to implement. WDM by WS would be allowed on BWI airport and adjacent properties (within 2 miles of airport property), when requested, where a need has been documented and upon completion of an Agreement for Control. All management actions would comply with appropriate federal, state, and local laws.

3.1.2 Alternative 2 – WS non-lethal WDM program only.

This alternative would require WS to use and recommend non-lethal methods only to resolve wildlife damage problems. Requests for information regarding lethal management approaches would be referred to MDNR, USFWS, local animal control agencies, or private businesses or organizations. Individuals might choose to implement WS non-lethal recommendations, implement lethal methods or other methods not recommended by WS, contract for WS direct control services, use contractual services of private businesses, or take no action. Currently, DRC-1339 and Alpha-Chloralose are only available for use by WS employees. Therefore, use of these chemicals by private individuals would be illegal. Under this alternative, Alpha-Chloralose or other approved capture drugs would be used by WS personnel to capture and relocate wildlife. Appendix C describes a number of non-lethal methods available for use or recommendation by WS under this alternative.

3.1.3 Alternative 3 – WS lethal WDM program only.

Under this alternative, WS would provide only lethal direct control services and technical assistance. Technical assistance would include making recommendations to the USFWS and MDNR regarding the issuance of permits to resource owners to allow them to take wildlife by lethal methods. Requests for

information regarding non-lethal management approaches would be referred to MDNR, USFWS, local animal control agencies, or private businesses or organizations. Individuals might choose to implement WS lethal recommendations, implement non-lethal methods or other methods not recommended by WS, contract for WS direct control services, use contractual services of private businesses, or take no action. In some cases, control methods employed by others could be contrary to the intended use or in excess of what is necessary. Appendix C describes a number of lethal methods available for use or recommendation by WS under this alternative.

3.1.4 Alternative 4 - No WS WDM program.

This alternative would eliminate all WS involvement in WDM at BWI airport. WS would not provide direct operational or technical assistance and requesters of WS services would have to conduct their own WDM without WS input. Requests for information would be referred to MDNR, USFWS, local animal control agencies, or private businesses or organizations. Individuals might choose to conduct WDM themselves, use contractual services of private businesses, or take no action. DRC-1339 and Alpha-Chloralose are only available for use by WS employees. Therefore, use of these chemicals by private individuals would be illegal.

3.2 WDM Strategies and Methodologies Available to WS

The strategies and methodologies described below include those that could be used or recommended under Alternatives 1, 2, and 3 described above. Alternative 4 would terminate both WS technical assistance and operational WDM by WS. Appendix C is a more thorough description of the methods that could be used or recommended by WS.

3.2.1 Integrated Wildlife Damage Management (IWDM)

The most effective approach to resolving wildlife damage is to integrate the use of several methods simultaneously or sequentially. The philosophy behind IWDM is to implement the best combination of effective management methods in a cost-effective[1] manner while minimizing the potentially harmful effects on humans, target and non-target species, and the environment. IWDM may incorporate cultural practices (i.e., restricting flying times), habitat modification (i.e., exclusion), animal behavior modification (i.e., scaring), removal of individual offending animals, local population reduction, or any combination of these, depending on the circumstances of the specific damage problem.

3.2.1.1 Technical Assistance Recommendations

"Technical assistance" as used herein is information, demonstrations, and advice on available and appropriate wildlife damage management methods. The implementation of damage management actions is the responsibility of the requester. In some cases, WS provides supplies or materials that are of limited availability for non-WS entities to use technical assistance may be provided following a personal or telephone consultation, or during an on-site visit with the requester. Generally, several management strategies are described to the requester for short and long-term solutions to damage problems; these strategies are based on the level of risk, need, and the practicality of their application.

Under APHIS NEPA Implementing regulations and specific guidance for the WS program, WS technical assistance is categorically excluded from the need to prepare an EA or EIS. However, it is discussed in this EA because it is an important component of the IWDM approach to resolving wildlife damage problems.

3.2.1.2 Direct Damage Management Assistance

[1] The cost of management may sometimes be secondary because of overriding environmental, legal, human health and safety, animal welfare, or other concerns

This is the implementation or supervision of damage management activities by WS personnel. Direct damage management assistance may be initiated when the problem cannot effectively be resolved through technical assistance alone, and when Agreements for Control or other comparable instruments provide for WS direct damage management. The initial investigation defines the nature, history, extent of the problem, species responsible for the damage, and methods that would be available to resolve the problem. Professional skills of WS personnel are often required to effectively resolve problems, especially if restricted use pesticides or controlled substances are necessary, or if the problem is complex.

3.2.2 Examples of WS Direct Operational and Technical Assistance in WDM at BWI Airport

WS has implemented and conducted several projects that provide both Operational and Technical Assistance (TA) at BWI airport. Such projects include but are not limited to the problems of white-tailed deer (*Odocoileus virginianus*), Canada Geese (*Branta canadensis*), gulls (*Larus spp.*) and woodchucks (*Marmota monax*) on the airfield and runway; European starlings (*Sturnus vulgarus)* nesting in loading bridges and buildings posing serious risk to aircraft and health risks associated with droppings; and waterfowl and gull strike risks.

- WS has provided technical assistance and operational assistance to airports to reduce waterfowl activity on airport property and within critical air space. A combination of active harassment, bird exclusion devices, habitat modification recommendations and direct control have been used to reduce the risk of bird strikes.
- WS has provided technical assistance to airport operations to reduce white-tailed deer activities on airport property by making recommendations such as modifying the habitat and closing any gaps in the fence around the airfield. WS also monitors for the presence of white-tailed deer activity by conducting spotlighting surveys at night. Direct control methods employed by WS include harassment and lethal removal by sharp shooting and trapping.
- WS has provided technical assistance to airport personnel to reduce starling nesting activities on airport properties by providing information on habitat and behavior modification, and proper exclusion and harassment using multiple techniques. WS has also provided direct control through harassment using pyrotechnics.
- WS has provided TA to Maryland Aviation Administration's Environmental Planning Division on land use planning and development on/around BWI Airport property critical airspace by recommending changes in habitat and harassment techniques.
- Direct control provided by WS has included harassing vultures, crows, gulls and geese through the use of pyrotechnics, proper use of gas cartridges for woodchuck control, and lethal removal of some species, such as, white-tailed deer.

3.2.3 WS Decision-Making

WS personnel use a thought process for evaluating and responding to damage complaints that is depicted by the WS Decision Model described by Slate et al. (1992) (Appendix B). WS personnel are frequently contacted after requesters have tried or considered non-lethal methods and found them to be impractical, too costly, or inadequate for reducing damage to an acceptable level. WS personnel assess the problem, evaluate the appropriateness and availability (legal and administrative) of strategies and methods based on biological, economic and social considerations. Following this evaluation, the methods deemed to be practical for the situation are developed into a management strategy. After the management strategy has been implemented, monitoring is conducted and evaluation continues to assess the effectiveness of the strategy. If the strategy is effective, the need for further management is ended. In terms of the WS Decision Model (Slate et al. 1992), most damage management efforts consist of continuous feedback between receiving the request and monitoring the results of the damage management strategy. The Decision Model is not a documented process, but a mental problem-solving process common to most if not all professions.

3.2.4 Wildlife Damage Management Methods Available for Use. (See Appendix C for detailed descriptions of WDM Methodologies)

3.2.4.1 Non-chemical, Non-lethal Methods (See Appendix C for detailed descriptions)

Property owner practices consist primarily of non-lethal preventive methods such as cultural methods[2] and habitat modification.

Animal behavior modification refers to tactics that alter the behavior of wildlife to reduce damages. Some but not all of these tactics include:

- Exclusions such as fencing
- Propane cannons (to scare birds and mammals)
- Pyrotechnics (to scare birds and mammals)
- Distress calls and sound producing devices (to scare birds)
- Visual repellents and scaring tactics
- Lasers (to scare birds)

Relocation of damaging birds as directed by MDNR to other areas.

Nest destruction of the target species before eggs or young is in the nest.

Egg addling/destruction is the practice of destroying the embryo in the egg prior to hatching; physically breaking eggs; or directly removing eggs from a nest and destroying them.

Habitat/environmental modification to attract or repel certain wildlife species.

Live traps are various types of traps designed to capture birds and mammals alive for relocation or euthanasia. Some examples are, snares, leg-hold traps, cage traps, clover traps, decoy traps, nest box traps, mist nets, etc.

3.2.4.2 Chemical, Non-lethal Methods (See Appendix C for detailed descriptions)

Avitrol® is a chemical frightening agent registered for use on pigeons, crows, gulls, blackbirds, starlings, and English sparrows in various situations. This chemical works by causing distress behavior in the birds that consume treated kernels from a mixture of treated and untreated bait, which generally frightens the other birds from the site. Generally birds that eat the treated bait will die (Johnson and Glahn 1994).

Alpha-chloralose is used as an immobilizing agent, which is a central nervous system depressant, and used to capture waterfowl or other birds. It is generally used in recreational and residential areas, such as swimming pools, shoreline residential areas, golf courses, or resorts. Alpha-chloralose is typically delivered as a well-contained bait in small quantities with minimal hazards to pets and humans; single bread or corn baits are fed directly to the target birds.

Methyl Anthranilate (MA) (artificial grape flavoring food additive) has been shown to be an effective repellent for many bird species, including waterfowl. It can be applied to turf or surface water or as a fog to repel birds from small areas. It may also become available for use as a livestock feed additive that has bird repellent value.

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[2] Generally involves modifications to the management of protected resources to reduce their vulnerability to wildlife damage

Flight Control® (anthraquinone) (Avery et al. 1997) The chemical bird repellent Flight Control could be used to reduce feeding activity on the airfield. Flight Control is a bio-pesticide that is non-lethal and works by causing a negative response to feeding in the treated area.

3.2.4.3 Mechanical, Lethal Methods (See Appendix C for detailed descriptions)

Shooting is the practice of selectively removing target species by shooting with an air rifle, shotgun, or rifle. Shooting a few individuals from a larger flock can reinforce birds' fear of harassment techniques.

Snap traps may be used to remove small rodents and may also be modified to remove individual birds such as woodpeckers and starlings.

Body grip (e.g. conibear) traps are kill traps designed to cause the quick death of the animal that activates the trap. The Conibear size 330 traps used for beaver are used exclusively in aquatic habitats, with placement depths varying from a few inches to several feet below the water surface. Smaller body grip traps, such as the size 110 used for muskrats, can be set either in or out of the water.

Cervical dislocation is sometimes used to euthanize small rodents and birds that are captured in live traps. AVMA approves this technique as humane method of euthanasia and states that cervical dislocation when properly executed is a humane technique for euthanasia of rodents, poultry, and of small birds (Beaver et al. 2001).

3.2.4.4 Chemical, Lethal Methods (See Appendix C for detailed descriptions)

DRC-1339 is an avacide for reducing damage from several species of birds, including blackbirds, starlings, pigeons, crows, ravens, magpies, and gulls. DRC-1339 is highly toxic to sensitive species but only slightly toxic to non-sensitive birds, predatory birds and mammals. This chemical would be the primary lethal chemical method used for feral domestic pigeon, starling, and blackbird damage management under the current program.

Carbon dioxide (CO_2) gas is an American Veterinary Medical Association (AVMA) approved euthanasia method (Beaver et al. 2001) which is sometimes used to euthanize birds and mammals which are captured in live traps or by chemical immobilization and when relocation is not a feasible option. Live animals are placed in a container or chamber into which CO_2 gas is released. The animals quickly expire after inhaling the gas.

Gas Cartridge is registered as a fumigant by the EPA. When ignited, the cartridge burns in the den of an animal and produces large amounts of carbon monoxide, a colorless, odorless, and tasteless, poisonous gas. The combination of oxygen depletion and carbon monoxide exposure kills the animals in the den.

Zinc phosphide is a metallic toxicant most often used for rodent control, such as rats, mice, voles, and muskrats. It can be used to treat a variety of baits, depending on the species being controlled.

Warfin and Diphacinone are anticoagulant rodenticides used to control rodents around buildings and other structures.

3.3 Alternatives Considered But Not Analyzed in Detail with Rationale

3.3.1 Technical Assistance Only

This alternative would not allow a WS operational WDM program at BWI airport. WS would only provide technical assistance and make recommendations when requested. This alternative has been determined

ineffective based upon the unsuccessful attempts by airport personnel to conduct WDM prior to WS direct control involvement

3.3.2 White-tailed deer population stabilization through birth control.

Deer would be sterilized or contraceptives administered to limit the ability of deer to produce offspring. Contraceptive measures for deer can be grouped into four categories: surgical sterilization, oral contraception, hormone implantation, and immunocontraception (the use of contraceptive vaccines). These techniques would require that deer receive either single, multiple, or possibly daily treatment to successfully prevent conception. The use of this method would be subject to approval by Federal and State Agencies. This alternative was not considered in detail because: (1) it would take a number of years of implementation before the deer population would decline and therefore, damage would continue at the present unacceptable levels for a number of years; (2) surgical sterilization would have to be conducted by licensed veterinarians, would therefore be extremely expensive, (3) it is difficult, time-consuming, and expensive to effectively live trap, chemically capture, or remotely treat the number of deer necessary to effect an eventual decline in the population; (4) no chemical or biological agents for contracepting deer have been approved for use by State and Federal regulatory authorities.

3.3.3 Live-capture and relocation of white-tailed deer.

Under this alternative WS would capture deer alive using cage-type live traps or capture drugs administered by dart gun and then relocate the captured deer to another area. Numerous studies have shown that live-capture and relocation of deer is relatively expensive, time-consuming, and inefficient (Ishmael and Rongstad 1984, O'Bryan and McCullough 1985, Diehl 1988, Jones and Witham 1990, Ishmael et al. 1995). Population reduction achieved through capture and relocation is labor intensive and would be costly ($273-$2,876/deer) (O'Bryan and McCullough 1985, Bryant and Ishmael 1991). Additionally, relocation frequently results in high mortality rates for relocated deer (Cromwell et. al. 1999, O'Bryan and McCullough 1985, Jones and Witham 1990, Ishmael et al. 1995). Deer frequently experience physiological trauma during capture and transportation and deer mortality after relocation has ranged from 25-89% (Jones and Witham 1990, Mayer et al. 1993). O'Bryan and McCullough (1985) found that only 15% of radio-collared black-tailed deer that were live-captured and relocated from Angel Island, California, survived for 1 year after relocation. Although relocated deer usually do not return to their location of capture, some do settle in familiar suburban habitats and create nuisance problems for those communities (Bryant and Ishmael 1991). High mortality rates of relocated deer, combined with the manner in which many of these animals die, make it difficult to justify relocation as a humane alternative to lethal removal methods (Bryant and Ishmael 1991). Chemical capture methods require specialized training and skill. A primary limitation of darting is the limited range at which deer can be effectively hit which is generally less than 40 yards. With modern scoped rifles, however, a skilled sharpshooter can hit the head or neck of a deer for a quick kill out to 200 yards and beyond. Thus, chemical capture is far less efficient, more labor intensive, and much more costly than removal with rifles. Additionally, the American Veterinary Medical Association, the National Association of State Public Health Veterinarians, and the Council of State and Territorial Epidemiologists oppose relocation of mammals because of the risk of disease transmission (USDA 1997).

3.4 Mitigation and Standard Operating Procedures for Wildlife Damage Management Techniques

3.4.1 Mitigation in Standard Operating Procedures (SOP)

Mitigation measures are any features of an action that serve to prevent, reduce, or compensate for impacts that otherwise might result from that action. The current WS program, nationwide and in Maryland uses many such mitigation measures and these are discussed in detail in Chapter 5 of the FEIS (USDA 1997). Some key mitigating measures pertinent to the proposed action and alternatives that are incorporated into WS's Standard Operating Procedures include:

Mitigation Measures	Alternatives			
	1	2	3	4
Animal Welfare and Humaneness of Methods used by WS				
Research on selectivity and humaneness of management practices would be monitored and adopted as appropriate	X	X	X	
The Decision Model (Slate et al. 1992) is used to identify effective biological and ecologically sound WDM stategies and their impacts.	X	X	X	
Captured non-target animals are relocated unless it is determined by WS personnel that the animal would not survive	X	X	X	
The use of traps and snares conform to current laws and regulations administered by MDNR and MD WS policy.	X	X	X	
Euthanasia procedures approved by the AVMA that cause minimal pain are used for live captured animals.	X		X	
The use of newly developed, proven non-lethal methods would be encouraged when appropriate.	X	X		
Safety Concerns Regarding WS WDM Methods				
All pesticides are registered with the EPA and MDA.	X	X	X	
WS employees would follow all EPA approved label directions.	X	X	X	
The Decision Model (Slate et al. 1992), designed to identify the most appropriate damage management strategies and their impacts, is used to determine WDM strategies.	X	X	X	
WS employees that use pesticides are trained to use each material and are certified to use pesticides under EPA approved certification programs.	X	X	X	
WS employees who use pesticides participate in State approved continuing education to keep abreast of developments and maintain their certifications.	X	X	X	
Pesticide use, storage, and disposal conform to label instruction and other applicable laws and regulations, and Executive Order 12898.	X	X	X	
Material Safety Data Sheets for pesticides are provided to all WS personnel involved with specific WDM activities.	X	X	X	
Concerns about Impacts of WDM on Target Species, Species of Special Concern, and Non-target Species				
WS consulted with the USFWS regarding the	X	X	X	

Mitigation Measures	Alternatives			
nation-wide program and would continue to implement all applicable measure identified by the USFWS to ensure protection of T &E species.				
Management actions would be directed toward localized populations or groups and/or individual offending animals.	X	X	X	
WS personnel are trained and experienced to select the most appropriate methods for taking targeted animals and excluding non-target species.	X	X	X	
WS would initiate consultation with the USFWS following any incidental take of T&E species.	X	X	X	
The presence of non-target species is monitored before using toxicants to reduce the risk of significant mortality of non-target species populations.	X		X	
WS take is monitored by number of animals by species or species groups (i.e. blackbirds, raptors) with overall populations or trends in population to assure the magnitude of take is maintained below the level that would cause significant adverse impacts to the viability of native species populations (See Chapter 4).	X		X	
WS uses chemical methods for WDM that have undergone rigorous research to prove their safety and lack of serious effects on non-target animals and the environment.	X	X	X	

4.0 CHAPTER 4: ENVIRONMENTAL CONSEQUENCES

Chapter 4 provides information needed for making informed decisions in selecting the appropriate alternative for meeting the purpose of the proposed action. The chapter analyzes the environmental consequences of each alternative in relation to the issues identified for detailed analysis in Chapter 2. This section analyzes the environmental consequences of each alternative in comparison with the No Action alternative to determine if the real or potential impacts would be greater, lesser, or the same. Therefore, the proposed action alternative serves as the baseline for the analysis and the comparison of expected impacts among the alternatives. The background and baseline information presented in the analysis of the current program alternative thus also applies to the analysis of each of the other alternatives. The No Action Alternative, as defined here, is consistent with the Council on Environmental Quality (CEQ) (1981).

The following resource values within the State are not expected to be significantly impacted by any of the alternatives analyzed: soils, geology, minerals, water quality/quantity, flood plains, wetlands, visual resources, air quality, prime and unique farmlands, aquatic resources, timber, and range. These resources will not be analyzed further.

Cumulative Impacts: Discussed in relationship to each of the potentially affected species analyzed in this chapter.

Irreversible and Irretrievable Commitments of Resources: Other than minor uses of fuels for motor vehicles and other materials, there are no irreversible or irretrievable commitments of resources.

Impacts on sites or resources protected under the National Historic Preservation Act: WS WDM actions are not undertakings that could adversely affect historic resources (See Section 1.8.2.5).

4.1 Environmental Consequences for Issues Analyzed in Detail

4.1.1 Effects on Target Species Wildlife Populations

4.1.1.1 Alternative 1. - WS Integrated WDM program (Proposed Action/No Action)

Analysis of this issue is limited primarily to those species most often killed during WS WDM. The analysis for magnitude of impact generally follows the process described in Chapter 4 of USDA (1997). Magnitude is described in USDA (1997) as " . . . *a measure of the number of animals killed in relation to their abundance*." Magnitude may be determined either quantitatively or qualitatively. Quantitative determinations are based on population estimates, allowable harvest levels, and actual harvest data. Qualitative determinations are based on population trends and harvest data when available.

Generally, WS only conducts damage management on species whose population densities are high and usually only after they have caused damage. Table 4-1 shows the numbers of birds and mammals harassed and/or killed by species as a result of WS WDM activities at BWI airport from August 2001 through May 2003.

WS's activities in resolving wildlife damage totaled approximately 46% non-lethal techniques -- for example; American Crows were not killed by WS personnel, while the number moved by use of harassment with pyrotechnics totaled an estimated 472 individual birds.

Table 4-1. Wildlife Harassed and Lethally Removed by WS for Wildlife Damage Management from August 2001 through May 2003 at BWI Airport.

Species	Dispersed/Freed	Killed
Blackbirds (Mixed)	520	0
American Crow	472	0
Canada Geese	483	18
Gulls, Bonaparte's	120	1

Gulls, Ring-billed	1,244	31
Hawks, Red-tailed	2	0
Mallards	257	10
Robins, American	230	0
Starling, European	200	0
Vulture, Black	3	0
White-tailed Deer	11	77
Woodchuck	0	26

Breeding Bird Surveys. Bird populations can be monitored by using data from the Breeding Bird Surveys (BBS). The BBS is a large-scale inventory of North American birds coordinated by the U.S. Geological Survey, Patuxent Wildlife Research Center (Sauer et al 2003). The BBS is a combined set of over 3,700 roadside survey routes primarily covering the continental United States and southern Canada. The BBS was started in 1966, and routes are surveyed in June by experienced birders. The stated primary objective of the BBS has been to generate an estimate of population change for all breeding birds. Populations of birds tend to fluctuate, especially locally, as a result of variable annual local habitat and climatic conditions. Trends can be determined using different population equations, and statistically tested to determine if a trend is significant. The significance of a trend's "change" is reflected in the calculated P-value (probability) for that species.

The BBS data is best used to monitor population trends. However, the average number of birds per route (relative abundance) can be used to theoretically estimate the population size (relative abundance/10 mi^2 x 12,297 (total land/water area in Maryland)). To use these population estimates the following assumptions would need to be accepted.

1. All birds within a quarter mile of the observer are seen at all stops on a BBS route; this assumption is faulty because observers often cannot see a quarter mile in radius at all stops due to obstructions such as hills, trees, and brush and because some bird species can be very elusive. Therefore, the number of birds seen per route would provide a conservative estimate of the population.
2. The chosen survey routes are totally random and are fully representative of available habitats. When BBS routes are established, survey rules allow the observers to make stops for surveys based on better quality habitat or convenient parking areas, even though the survey sites are supposed to be spaced a half-mile apart. Therefore, if survey areas had stops with excellent food availability, the count survey could be biased. This would tend to overestimate the population. However, if these sites were not on a route at all, the population could be underestimated.
3. Birds are equally distributed throughout the survey area and routes were randomly selected. Routes are randomly picked throughout the State, but are placed on the nearest available road. Therefore, the starting point is picked for accessibility by vehicle. However a variety of habitat types are typically covered since most BBS routes are selected because they are "off the beaten path" to allow observers to hear birds without interruption from vehicular noise.

Christmas Bird Counts. The National Audubon Society (NAS) conducts nationwide bird surveys in December to early January (the NAS Christmas Counts). The Christmas Bird Counts (CBC) reflect the number of birds frequenting the state during the winter months. The CBC data does not provide a population estimate, but can be used as an indicator of trends in the population. Researchers have found that population trends reflected in CBC data tend to correlate well with those from censuses taken by more stringent means (National Audubon Society 2002).

European Starling and Blackbird (red-winged blackbirds, brown headed cowbird, common grackle) Population Impacts

Colonization of North America by the European Starling began on March 6, 1890 when a Mr. Eugene Scheifflin, a member of the Acclimatization Society, released 80 starlings into New York's Central Park. The birds thrived and exploited their new habitat. By 1918, the advance line of migrant juveniles extended

from Ohio to Alabama; by 1926 from Illinois to Texas; by 1941 from Idaho to New Mexico; and by 1946 to California and Canadian coasts (Miller 1975). In just 50 short years the starling had colonized the United States and expanded into Canada and Mexico and 80 years after the initial introduction had become one of the most common birds in North America (Feare 1984).

Red-winged blackbirds, common grackles, stralings and brown-headed cowbirds are considered to be part of the blackbird species group described in USDA (1997) and are estimated to represent 38%, 22%, 20% and 18% of this group, respectively (Meanley and Royall 1976).

Precise counts of blackbird and starling populations do not exist but one estimate placed the United States summer population of the blackbird group at over 1 billion (USDA 1997) and the winter population at 500 million (Royall 1977). The majority of these birds occur in the eastern U.S.; for example surveys in the southeastern part of the country estimated 350 million blackbirds and starlings in winter roosts (Bookhout and White 1981). Meanley and Royal (1976) estimated 538 million blackbirds and starlings in winter roosts across the country during the winter of 1974-75. The nationwide starling population has been estimated at 140 million (Johnson and Glahn 1994).

Natural mortality in blackbird populations is between 50% and 65% of the population each year, regardless of human-caused control operations (USDA 1997). Annual populations of the blackbird group in the eastern U.S. is at least 372 million, of which an estimated 140 million are starlings (Meanley and Royall 1976, Johnson and Glahn 1994). Therefore the estimated natural mortality of the blackbird group in the eastern U.S should be between 186 and 241 million birds annually. No blackbirds and/or starlings have been killed by WS at BWI Airport, and would be expected to be no more than approximately 10,000 starlings and 21,000 blackbirds total mortality in any one year. Regionally, WS's *confirmed kill*, which may be underestimated, averages less than a 131,068 blackbirds and starlings annually, which accounts for only 0.005% of the natural mortality. Even if WS's actual regional kill is much higher than the "confirmed" kill, it should continue to be well below normal mortality levels for these populations.

Dolbeer et al. (1995) showed that WS kills of 3.6% of the wintering population had no effect on breeding populations the following spring. Dolbeer et al. (1976) constructed a population model which indicated that a reduction of 14.8% of the wintering blackbird population would reduce the spring breeding population by 20% and that a 56.2% reduction in the wintering blackbird population would reduce spring breeding populations by only 33%. Given the density-dependent relationships in a blackbird population (i.e. decreased mortality and increased fecundity of surviving birds) a much higher number would likely have to be killed in order to impact the regional breeding population.

Breeding Bird Survey trend data from 1966-2002 indicate that European starling populations have decreased at an annual rate of -1.0%, -0.6%, and -0.9% throughout Maryland, the United States, and the eastern region, respectively (Sauer et al. 2003). With a relative abundance of 97.75, a total Maryland summer starling population could be estimated at approximately 120,200 birds. Maryland Christmas Bird Count data from 1966-2002 shows a relatively stable population trend for wintering populations of starlings throughout the state (National Audubon Society 2002).

Breeding Bird Survey trend data from 1966-2002 indicate that red-winged blackbird populations have decreased at an annual rate of -0.4%, -0.9%, and -1.7% throughout Maryland, the United States, and the eastern region, respectively (Sauer et al. 2003). With a relative abundance of 49.72, a total Maryland summer red-winged blackbird population could be estimated at approximately 61,140 birds. Maryland Christmas Bird Count data from 1966-2002 shows a relatively stable population trend for wintering populations of red-winged blackbirds throughout the state (National Audubon Society 2002).

Breeding Bird Survey trend data from 1966-2002 indicate that brown headed cowbird populations have decreased at an annual rate of -0.2%, -0.9%, and -1.9% throughout Maryland, the United States and the eastern region, respectively (Sauer et al. 2003). With a relative abundance of 9.72, a total Maryland summer cowbird population could be estimated at approximately 12,000 birds. Maryland Christmas Bird

Count data from 1966-2002 shows a relatively stable population trend for wintering populations of cowbirds throughout the state (National Audubon Society 2002).

Breeding Bird Survey trend data from 1966-2002 indicate that common grackle populations have decreased at an annual rate of -1.3%, -1.4%, and -1.4% throughout Maryland, the United States, and the eastern region, respectively (Sauer et al. 2003). With a relative abundance of 122.65, a total Maryland summer grackle population could be estimated at approximately 150,800 birds. Maryland Christmas Bird Count data from 1966-2002 shows a relatively stable population trend for wintering populations of grackles throughout the state (National Audubon Society 2002).

Blackbird populations are healthy enough, and the problems they cause great enough, that the USFWS has established a standing depredation order for use by the public. Under this "order" (50 CFR 21.43), no Federal permit is required by anyone to remove blackbirds if they are committing or about to commit depredations upon ornamental or shade trees, agricultural crops, livestock, or wildlife, or when concentrated in such numbers and manner as to constitute a health hazard or other nuisance. The USFWS, as the agency with management responsibility, could impose restrictions on depredation harvest as needed to assure cumulative take does not adversely affect the continued viability of populations. This should assure that cumulative impacts on blackbird populations would have no significant adverse impact on the quality of the human environment.

Starlings, being non-indigenous and because of their negative impacts and competition with native birds, are considered by many wildlife biologists and ornithologists to be an undesirable component of North American wild and native ecosystems. Any reduction in starling populations in North America, even to the extent of complete eradication, could be considered a beneficial impact to native bird species.

It is anticipated that no more than approximately 10,000 European starlings and 21,000 blackbirds will be lethally taken on BWI airport and adjacent properties each year. Based on the above information, USFWS oversight, and WS limited lethal take of these blackbird species and starlings on BWI airport and adjacent properties, the WS WDM program should have minimal effects on local, statewide, regional or continental blackbird and starling populations. This is supported by the MDNR, which is the agency with responsibility for managing wildlife in the State (Annotated Code of MD, Natural Resources 10-202, 10-206, 10-901, 10-908).

American Crow Population Impacts

American crows have a wide range and are extremely abundant, being found in most of the United States (National Audubon Society, 2000). They are found in both urban and rural environments and sometimes form large communal roosts in cities. In the U. S., some crow roosts may reach a half-million birds (National Audubon Society, 2000). In fall and winter, crows form large flocks. The flocks roost together at night and disperse to different feeding areas during the day. Crows will fly up to 6-12 miles from the roost to a feeding site each day (Johnson 1994).

Breeding Bird Survey trend data from 1966-2002 indicate that American crow populations have increased at an annual rate of 1.8%, 1.4%, and 1.2% throughout Maryland, the United States, and the eastern region, respectively (Sauer et al. 2003). With a relative abundance of 44.95, a total Maryland summer crow population could be estimated at approximately 55,300 birds. Maryland Christmas Bird Count data from 1966-2002 shows a relatively stable trend for wintering populations of crows throughout the state (National Audubon Society 2002).

American crow populations are healthy enough, and the problems they cause great enough, that the USFWS has established a standing depredation order for use by the public. Under this "order" (50 CFR 21.43), no Federal permit is required by anyone to remove crows if they are committing or about to commit depredations upon ornamental or shade trees, agricultural crops, livestock, or wildlife, or when concentrated in such numbers and manner as to constitute a health hazard or other nuisance. The USFWS, as the agency with management responsibility, could impose restrictions on depredation harvest as needed

to assure cumulative take does not adversely affect the continued viability of populations. This should assure that cumulative impacts on crow populations would have no significant adverse impact on the quality of the human environment. The hunting season for crows in all counties of Maryland is from August 15 through March 15, Wednesday through Saturday only, with no restrictions set on bag or possession limits.

It is anticipated that no more than approximately 100 American crows will be lethally taken on BWI airport and adjacent properties each year. Based on the above information, USFWS oversight, and WS limited lethal take of American crows on BWI airport and adjacent properties, the WS WDM program should have minimal effects on local, statewide, regional or continental American crow populations. This is supported by the MDNR, which is the agency with responsibility for managing wildlife in the State (Annotated Code of MD, Natural Resources 10-202, 10-206, 10-901, 10-908).

House Sparrow Population Impacts

English sparrows, or house sparrows, were introduced to North America from England in 1850 and have spread throughout the continent (Fitzwater 1994). The species is not protected by Federal or Maryland state laws. Like European starlings and pigeons, because of their negative effects and competition with native bird species, English sparrows are considered by many wildlife biologists, ornithologists, and naturalists to be an undesirable component of North American native ecosystems. English sparrows are found in nearly every habitat except dense forest, alpine, and desert environments. They prefer human-altered habitats, and are abundant on farms and in cities and suburbs (Robbins et al. 1973).

Breeding Bird Survey trend data from 1966-2002 indicate that English sparrow populations have decreased at an annual rate of -3.5%, -2.5%, and -2.7% throughout Maryland, the United States, and the eastern region, respectively (Sauer et al. 2003). With a relative abundance of 65.59, a total Maryland summer sparrow population could be estimated at approximately 80,700 birds. Maryland Christmas Bird Count data from 1966-2002 shows declining population trend for wintering populations of sparrows throughout the state (National Audubon Society 2002).

One aspect of changing farming practices which might have been a factor would be the considerable decline in small farms and associated disappearance of a multitude of small feed lots, stables and barns, a primary source of food for these birds in the early part of the 20th century. Ehrlich et al. (1988) suggested that English sparrow population declines might be linked to the dramatic decrease during the 20th century in the presence of horses as transport animals. Grain rich horse droppings were apparently a major food source for this species.

It is anticipated that no more than approximately 100 house sparrows will be lethally taken on BWI airport and adjacent properties each year. Based on the above information and WS limited lethal take of house sparrows on BWI airport and adjacent properties, the WS WDM program should have minimal effects on local, statewide, regional or continental house sparrow populations. This is supported by the MDNR, which is the agency with responsibility for managing wildlife in the State (Annotated Code of MD, Natural Resources 10-202, 10-206, 10-901, 10-908).

Feral Domestic Pigeon (Rock Dove) Population Impacts

Domestic pigeons, or rock doves, are a non-indigenous species that were first introduced into the United States by European settlers as a domestic bird to be used for sport, carrying messages, and as a source of food (USFWS 1981). Many of these birds escaped and eventually formed the feral pigeon populations that are now found throughout the United States, southern Canada, and Mexico (Williams and Corrigan 1994). However, because pigeons are an introduced rather than a native species, they are not protected by federal law or Maryland state law.

Pigeons are highly dependent on humans to provide them with food and sites for roosting, loafing, and nesting (Williams and Corrigan 1994). Thus, they are commonly found around city buildings, bridges,

parks, farm yards, grain elevators, feed mills, and other manmade structures (Williams and Corrigan 1994). Additionally, although pigeons are primarily grain and seed eaters, they will readily feed on garbage, livestock manure, spilled grains, insects, and any other available bits of food (Williams and Corrigan 1994).

Breeding Bird Survey trend data from 1966-2002 indicate that pigeon populations have decreased at an annual rate of -2.2% throughout Maryland, are stable (0.0%) throughout the United States and have increased at an annual rate of 0.1% throughout the eastern region (Sauer et al. 2003). With a relative abundance of 13.41, a total Maryland summer pigeon population could be estimated at approximately 16,500 birds. Maryland Christmas Bird Count data from 1966-2002 shows a relatively stable population trend for wintering populations of pigeons throughout the state (National Audubon Society 2002).

Federal or state law does not protect the species. Any WDM involving lethal control actions by WS for this species would be restricted to isolated, individual sites, or communities. In those cases where feral domestic pigeons are causing damage or are a nuisance, complete removal of the local population could be achieved. This would be considered to be a beneficial impact on the human environment since the affected property owner or administrator would request it. Although regional population impacts would be minor, even if significant regional or nationwide reductions could be achieved, this would not be considered an adverse impact on the human environment because the species is not part of native ecosystems. However, some individuals who experience aesthetic enjoyment of pigeons may consider major population reduction in some localities a negative impact.

It is anticipated that no more than approximately 300 pigeons will be lethally taken on BWI airport and adjacent properties each year. Based on the above information and WS limited lethal take of pigeons on BWI airport and adjacent properties, the WS WDM program should have minimal effects on local, statewide, regional or continental pigeon populations. This is supported by the MDNR, which is the agency with responsibility for managing wildlife in the State (Annotated Code of MD, Natural Resources 10-202, 10-206, 10-901, 10-908).

Mourning Dove Population Impacts

Mourning doves are migratory game birds with substantial populations throughout much of North America. This species is the most abundant dove in North America, is the champion of multiple brooding in its range, and is expanding northward (Ehrlich et al. 1988). Many States in the U. S. have regulated annual hunting seasons for the species and take is liberal. Maryland maintains a hunting season each year and hunters in all counties may take 12 per day and possess up to 24 during legal harvest dates. Both the number of dove hunters and dove harvest has declined in Maryland. In the mid-1970's, an average of about 30,000 hunters harvested about 400,000 doves (MD Department of Natural Resources, Game Program Annual Report 2001-2002, unpublished report). According to this report, these numbers have slowly declined to the current levels of 10,000-15,000 hunters and an annual harvest of about 200,000 birds.

Breeding Bird Survey trend data from 1966-2002 indicate that mourning dove populations have increased at an annual rate of 0.3% and 0.5% throughout Maryland and the eastern region, respectively and have decreased at an annual rate of 0.3% throughout the United States (Sauer et al. 2003). With a relative abundance of 31.26, a total Maryland summer mourning dove population could be estimated at approximately 38,400 birds. Maryland Christmas Bird Count data from 1966-2002 shows a stable trend for wintering populations of mourning doves throughout the state (National Audubon Society 2002).

Mourning doves are protected by the USFWS under the Migratory Bird Treaty Act and the take is limited by permit. The USFWS, as the agency with management responsibility, could impose restrictions on depredation harvest as needed to assure cumulative take does not adversely affect the continued viability of populations. This should assure that cumulative impacts on morning dove populations would have no significant adverse impact on the quality of the human environment.

It is anticipated that no more than approximately 100 mourning doves will be lethally taken on BWI airport and adjacent properties each year. Based on the above information, hunter harvest data, USFWS

oversight, and WS limited lethal take of mourning doves on BWI airport and adjacent properties, the WS WDM program should have minimal effects on local, statewide, regional or continental mourning dove populations. This is supported by the MDNR, which is the agency with responsibility for managing wildlife in the State (Annotated Code of MD, Natural Resources 10-202, 10-206, 10-901, 10-908).

Canada Goose Population Impacts (Migratory and Resident Populations)

Canada geese are one of North America's greatest wildlife success stories, and most biologists believe that there are more Canada geese now than at any time in history (Rusch et al. 1995, Ankney 1996). Canada geese are a large waterfowl that is found throughout North America. Canada geese are a widespread occupant of open areas, ponds and wetlands. Their primary diet is vegetative matter that includes items such as grass, corn, and soybeans. Canada geese are also very adaptive to urban settings and often thrive in areas such as public parks and airport retention ponds.

The total number of Canada geese counted during the winter in North America has increased from 980,000 in 1960 to 3,734,500 in 2000 (Mid-winter Survey unpublished reports). There are two behaviorally distinct types of Canada goose populations: Resident and Migratory.

Resident Canada Geese

A resident Canada goose is one that nests and/or resides on a year round basis within the conterminous United States (Rusch et al. 1995, Ankney 1996). More specifically, the Atlantic Flyway Council defines a "resident" Canada goose in the Atlantic Flyway as geese that are hatched or nest in any Atlantic Flyway state, or in Canada at or below 48^0 N latitude and east of 80^0 W longitude, excluding Newfoundland. This population inhabits the States along the U.S. Atlantic Coast, southern Quebec, and the southern Maritime Provinces of Canada (U.S. Fish and Wildlife Service 2001). As their name implies, resident Canada geese spend most of the year near their breeding areas, although many in northern latitudes do make seasonal movements (Atlantic Flyway Council 1999). Resident Canada geese were introduced into the Atlantic Flyway during the early 1900's and now comprise the largest population of geese in the Flyway, with an estimated 1.1 million birds in Spring, 1999 (Atlantic Flyway Council 1999). Annual estimates of the Atlantic Flyway resident Canada goose population have increased an average of 8% per year since 1991 (USFWS 2001). Breeding Bird Survey trend data from 1966-2002 indicate that Canada goose populations have increased at an annual rate of 19.3%, 10.4%, and 20.5% throughout Maryland, the United States, and the eastern region, respectively (Sauer et al. 2003).

In Maryland, there are an estimated 98,000 resident Canada geese (Atlantic Flyway Council 1999). The MD resident Canada goose population (statewide) objective determined by the MDNR, and supported by the Atlantic Flyway Council, is 30,000 birds, which will provide optimal recreational opportunities, while reducing nuisance and damage complaints (Atlantic Flyway Council 1999).

Migratory Canada Geese

Migratory Canada geese are those which nest and raise their young in the arctic and sub-arctic regions of Canada. Migrant geese begin moving north in time to arrive on their breeding grounds concurrent with the disappearance of ice cover and the availability of nest sites. Migrant geese arrive on the breeding grounds from mid-April on James Bay, late April for Hudson Bay, mid-May for the Yukon-Kuskokwin Delta of Alaska, to June for the islands in the Arctic (Bellrose 1980). Migrating Canada geese move northward fairly gradually following the retreating snow cover (Bellrose 1980). For the last portion of migration, northern-nesting geese often overfly areas of snow in boreal forests to arrive on Arctic and Subarctic nesting areas just as spring breaks. The most southerly wintering geese leave their wintering areas in January and geese wintering at middle-latitudes move northward in March or April (Bellrose 1980).

Migrant Canada geese move much farther to wintering areas than do resident geese and are typically found in Maryland interspersed among resident goose populations during the fall and winter months.

Maryland Christmas Bird Count data from 1966-2002 shows a stable trend for wintering populations of Canada geese throughout the state (National Audubon Society 2002).

The Atlantic Population (AP) of migratory Canada geese nest throughout Quebec, especially along the Ungava Bay, the eastern shore of Hudson Bay, and the Ungava Peninsula (U.S. Fish and Wildlife Service 2001). In 2001, the number of breeding pairs for the Atlantic Population was estimated to be 146,000, 57% above the 2000 estimate, and the highest since the surveys were initiated in the late 1980's. Total spring (2001) population of Atlantic Population (migratory) Canada geese was 637,000 birds. The Atlantic Population status has improved rapidly since 1995 (when there was a low of 29,000 breeding pairs), when hunting seasons on migratory geese were closed (U.S. Fish and Wildlife Service 2001). The North Atlantic Population (NAP) of migratory Canada geese nest in Newfoundland and Labrador, and although they do mix with AP and Resident geese during the winter, they maintain more coastal distributions (U.S. Fish and Wildlife Service 2001). There are an estimated 129,300 NAP geese in the Atlantic Flyway.

During the winter months of 2002, an estimated 426,900 Canada geese occur in the state; this survey includes Canada Geese from both the resident and the Atlantic populations (MDNR, Game Program Annual Report 2001-2002).

The total Maryland Canada goose harvest included 17,900 during the September season, 7,700 during the regular resident goose season, and 12,500 during the late season (MDNR, Annual Game Program Report 2001-2002).

Canada geese are protected by the USFWS under the Migratory Bird Treaty Act and the take is limited by permit. The USFWS, as the agency with management responsibility, could impose restrictions on depredation harvest as needed to assure cumulative take does not adversely affect the continued viability of populations. This should assure that cumulative impacts on Canada goose populations would have no significant adverse impact on the quality of the human environment.

It is anticipated that no more than approximately 200 Canada geese (resident and migratory geese combined) will be lethally taken on BWI airport and adjacent properties each year.

Based on the above information, hunter harvest data, USFWS oversight, and WS limited lethal take of Canada geese on BWI airport and adjacent properties, the WS WDM program should have minimal effects on local, statewide, regional or continental Canada goose populations. This is supported by the MDNR, which is the agency with responsibility for managing wildlife in the State (Annotated Code of MD, Natural Resources 10-202, 10-206, 10-901, 10-908).

Mallard Duck Population Impacts

Mallard ducks occur across the continent in every U.S. state and Canadian province (Bellrose 1976). Mallards are most common in farmland with numerous ponds, lakes, and slowly flowing, winding streams; in areas with extensive or numerous marshes near extensive grasslands; and in idle and brushy areas dotted with ponds and laced with meandering streams (Hartman 1992). Mallards are also found in urban and suburban areas such as parks, golf courses, natural wetlands, retention ponds and lakes, housing complexes, and industrial parks.

Breeding Bird Survey trend data from 1966-2002 indicate that mallard duck populations have increased at an annual rate of 10.5%, 3.5%, and 3.5% throughout Maryland, the United States, and the eastern region, respectively (Sauer et al. 2003). Maryland Christmas Bird Count data from 1966-2002 shows an increasing population trend for wintering populations of mallard ducks throughout the state (National Audubon Society 2002). However, mallards were down from 58,800 in 2001 to 36,700 in 2002 (MDNR, Annual Game Program Report 2001-2002). The 2001 hunting season for ducks, except Black duck and Canvasback, is from October 6 through 13 and from November 2 through 23 with a limit for mallard

harvest of four per day. In the 2000 season, hunters bagged about 194,500 ducks throughout the state. Mallards comprised 34% of that harvest number (MDNR, Annual Game Program Report 2001-2002).

Mallard ducks are protected by the USFWS under the Migratory Bird Treaty Act and the take is limited by permit. The USFWS, as the agency with management responsibility, could impose restrictions on depredation harvest as needed to assure cumulative take does not adversely affect the continued viability of populations. This should assure that cumulative impacts on mallard duck populations would have no significant adverse impact on the quality of the human environment.

It is anticipated that no more than approximately 200 mallard ducks will be lethally taken on BWI airport and adjacent properties each year. Based on the above information, hunter harvest data, USFWS oversight, and WS limited lethal take of mallard ducks on BWI airport and adjacent properties, the WS WDM program should have minimal effects on local, statewide, regional or continental mallard duck populations. This is supported by the MDNR, which is the agency with responsibility for managing wildlife in the State (Annotated Code of MD, Natural Resources 10-202, 10-206, 10-901, 10-908).

Gull (Bonaparte's gull, herring gull, laughing gull, and ring-billed gull) Population Impacts

Gulls are migratory and are commonly found at freshly plowed fields, landfills, airports and near water. These birds are opportunists, finding food scraps from discarded trash from people, worms on runways and taxiways at airports following rains, bugs that are unearthed when fields are plowed and at landfills. Such behavior causes these birds to present considerable hazards to arriving and departing aircraft. Small flocks of gulls, typically numbering less than 50 birds, are frequently found in runway and taxiway areas following rains. Gull species that are found at BWI airport include the Bonaparte's gull, herring gull, laughing gull, and ring-billed gull.

Maryland Christmas Bird Count data from 1966-2002 shows a relatively stable trend for wintering populations of Bonaparte's gulls throughout the state (National Audubon Society 2002). No Breeding Bird Survey data was available for the Bonaparte's gull.

Herring gulls are the most widely distributed gulls in the Northern Hemisphere. These gulls breed in colonies near oceans, lakes, or rivers (Bent 1921). Herring gulls will nest in natural or man-made sites, such as rooftops and breakwalls (Blokpoel and Scharf 1991). Breeding Bird Survey trend data from 1966-2002 indicate that herring gull populations have increased at an annual rate of 21.0% throughout Maryland and have decreased at annual rate of -1.6 and -3.5% throughout the United States, and the eastern region, respectively (Sauer et al. 2003). With a relative abundance of 1.01, a total Maryland summer herring gull population could be estimated at approximately 1,240 birds. Maryland Christmas Bird Count data from 1966-2002 shows a relatively stable trend for wintering populations of herring gulls throughout the state (National Audubon Society 2002).

The breeding range of the laughing gull is along the Atlantic and Gulf coasts (Bent 1921). Laughing gulls nest in three types of habitats: salt marshes, sand (with much or little vegetation), and on rocky islands with grassy areas (Bull 1974). Breeding Bird Survey trend data from 1966-2002 indicate that laughing gull populations have increased at an annual rate of 9.6%, 4.0% and 4.1% throughout Maryland, the United States and the eastern region, respectively and (Sauer et al. 2003). With a relative abundance of 25.85, a total Maryland summer laughing gull population could be estimated at approximately 31,800 birds. Maryland Christmas Bird Count data from 1966-2002 shows a relatively stable trend for wintering populations of laughing gulls throughout the state (National Audubon Society 2002).

Ring-billed gulls are migratory birds which prefer to nest on islands with sparse vegetation. The breeding population of ring-billed gulls is divided into two populations; the western population and the eastern population. The eastern breeding population of the United States includes New York, Vermont, Ohio, Illinois, Michigan, Wisconsin, and Minnesota (Blokpoel and Tessier 1986). Breeding Bird Survey trend data from 1966-2002 indicate that ring-billed gull populations have increased at an annual rate of 15.1%, 3.4%, and 2.9% throughout Maryland, the United States and the eastern region, respectively (Sauer et al.

2003). With a relative abundance of 0.33, a total Maryland summer laughing gull population could be estimated at approximately 400 birds. Maryland Christmas Bird Count data from 1966-2002 shows an increasing trend for wintering populations of ring-billed gulls throughout the state (National Audubon Society 2002).

Gulls are protected by the USFWS under the Migratory Bird Treaty Act and the take is limited by permit. The USFWS, as the agency with management responsibility, could impose restrictions on depredation harvest as needed to assure cumulative take does not adversely affect the continued viability of populations. This should assure that cumulative impacts on gull populations would have no significant adverse impact on the quality of the human environment.

It is anticipated that no more than approximately 20 Bonaparte's gulls, 20 herring gulls, 20 laughing gulls, and 100 ring-billed gulls will be lethally taken on BWI airport and adjacent properties each year. Based on the above information, USFWS oversight, and WS limited lethal take of gulls on BWI airport and adjacent properties, the WS WDM program should have minimal effects on local, statewide, regional or continental Bonaparte's gull, herring gull, laughing gull, and ring-billed gull populations. This is supported by the MDNR, which is the agency with responsibility for managing wildlife in the State (Annotated Code of MD, Natural Resources 10-202, 10-206, 10-901, 10-908).

White-tailed Deer Population Impacts

White-tailed deer are protected by Maryland state law. The MDNR, as the agency with management responsibility, could impose restrictions on depredation harvest as needed to assure cumulative take does not adversely affect the continued viability of local and statewide deer populations. This should assure that cumulative impacts on white-tailed deer populations would have no significant adverse impact on the quality of the human environment.

The MDNR is responsible for the management and monitoring of the states white-tailed deer, which is done through examination of harvest data, a deer-vehicle collision index and a crop damage index. In 2002, the MDNR estimated the statewide white-tailed deer population at 296,000 deer (MDNR 2003). The state has maintained statewide deer zones, and manages the deer herd on a statewide basis. During the 2002-2003 hunting season, hunters harvested 94,114 deer (MDNR 2003). In 2002, a total of 12,157 deer were taken on deer management permits and there were approximately 3,691 deer-vehicle collisions, with many collisions and near misses going unreported (MDNR 2003). WS work at BWI airport has resulted in the removal of 11 white-tailed deer during CY 2001 and 52 during CY2002.

Overall, the state's deer population is healthy and productive. Though the state-wide deer population has remained relatively stable for the past several years, significant increases in suburban landscapes have occurred. Deer populations have escalated in these suburban landscapes where excellent habitat is available and hunting is limited (MDNR 2003).

It is anticipated that no more than approximately 75 white-tailed deer will be lethally taken on BWI airport and adjacent properties each year. Based on the above information, hunter harvest data, MDNR oversight, and WS limited lethal take of white-tailed deer on BWI airport, the WS WDM program should have minimal effects on local and statewide deer populations. This is supported by the MDNR, which is the agency with responsibility for managing wildlife in the State (Annotated Code of MD, Natural Resources 10-202, 10-206, 10-901, 10-908).

Red and Gray Fox Population Impacts

Red foxes are adaptable to most habitats within their range, but usually prefer open country with moderate cover. Some of the highest fox densities reported are in the north-central U. S., where woodlands are interspersed with farmlands. Red foxes have also demonstrated their adaptability by establishing breeding populations in many urban areas of the U. S., Canada, and Europe (Phillips and Schmidt 1994). Home ranges for red foxes in the eastern U. S. are usually from 1,235 - 4,940 acres in rural settings such as

farmland (Voigt and Tinline 1980), but such sizes may not apply among fox populations in urban settings. Using the assumption that red foxes are only found in rural areas; that only one fox occupies a home range; that no home ranges overlap; and that there are 4.9 million acres of rural habitat in Maryland (U.S. Census Bureau 1999), a statewide population of red fox could be conservatively estimated at between 992 to 3,968 foxes.

The gray fox is common in many parts of the U. S. Gray foxes prefer habitat with dense cover such as thickets, riparian areas, swamp land, or rocky pinyon-cedar ridges. In eastern North America, this species is closely associated with edges of deciduous forest. They can also be found in urban areas where suitable habitat exists (Phillips and Schmidt 1994). Published estimates of gray fox density vary from 1,984 - 3,456/acre depending on location, season, and method of estimation (Errington 1933, Gier 1948, Lord 1961, Trapp 1978). Using the assumption that gray foxes are only found in rural areas; that only one fox occupies a home range; that no home ranges overlap; and that there are 4.9 million acres of rural habitat in Maryland (U.S. Census Bureau 1999), a statewide population of gray fox could be conservatively estimated at between 1,418 to 2,470 foxes.

Foxes cause hazards when they travel, hunt or scavenge along runways. Red and gray fox are protected by Maryland state law. MDNR is responsible for the management of wild canids including red fox and gray fox. The MDNR indicate that statewide red and gray fox population densities are stable to increasing (MDNR 2003). The 2002 fox hunting and trapping season runs from November 1 through January 6 in Anne Arundel County. There are no daily, possession or season limits for fox in the state.

The MDNR, as the agency with management responsibility, could impose restrictions on depredation harvest as needed to assure cumulative take does not adversely affect the continued viability of local and statewide red fox populations. This should assure that cumulative impacts on mammal populations would have no significant adverse impact on the quality of the human environment.

It is anticipated that no more than approximately 25 foxes (red and gray fox combined) will be lethally taken on BWI airport and adjacent properties each year. Based on the above information, MDNR oversight, and WS limited lethal take of red and gray fox on BWI airport and adjacent properties, the WS WDM program should have minimal effects on local and statewide red fox populations. This is supported by the MDNR, which is the agency with responsibility for managing wildlife in the State (Annotated Code of MD, Natural Resources 10-202, 10-206, 10-901, 10-908).

Cotton-tailed Rabbits Population Impacts

Cotton-tailed rabbits tend to concentrate in favorable habitats such as brushy fence rows or field edges, gullies filled with debris, brush piles, areas of dense briars invaded with Japanese honeysuckle, or landscaped backyards where food and cover are suitable. Within these habitats they spend their entire lives in an area of 10 acres or less. Occasionally they may move a mile or so from summer range to winter cover or to a new food supply. In suburban areas, rabbits are numerous and mobile enough to fill any "empty" habitat created when other rabbits are removed. Rabbits live only 12-15 months, yet make the most of time available reproductively They can raise as many as 6 litters per year of 1-9 young (usually 4-6), having a gestation period of 28 -32 days. Population densities vary with habitat quality, but 1 rabbit per 1 acre is a reasonable average (Craven 1994). On average, only 20 to 25% of young rabbits live 1 full year. Including adult mortality, about 85% of the population dies each year (Tjaden 2003). Using the assumption that rabbits are only found in rural areas; that only one rabbit occupies a home range; that no home ranges overlap; and that there are 4.9 million acres of rural habitat in Maryland (U.S. Census Bureau 1999), a statewide population of cotton-tailed rabbits could be conservatively estimated at approximately 5 million rabbits.

Cotton-tailed rabbits are protected by Maryland state law. The MDNR, as the agency with management responsibility, could impose restrictions on depredation harvest as needed to assure cumulative take does not adversely affect the continued viability of local and statewide rabbit populations. This should assure that cumulative impacts on cotton-tailed rabbit populations would have no significant adverse impact on

the quality of the human environment. In 2001, the legal hunting season for eastern cottontail rabbits was November 2 through February 8 with a daily limit of four and a possession limit of eight.

It is anticipated that no more than approximately 50 cotton-tailed rabbits will be lethally taken on BWI airport and adjacent properties each year. Based on the above information, MDNR oversight, and WS limited lethal take of cotton-tailed rabbits on BWI airport and adjacent properties, the WS WDM program should have minimal effects on local and statewide rabbit populations. This is supported by the MDNR, which is the agency with responsibility for managing wildlife in the State (Annotated Code of MD, Natural Resources 10-202, 10-206, 10-901, 10-908).

Woodchuck Population Impacts

Woodchucks are a large rodent, often seen in pastures, meadows, and fields. They dig large burrows 8-12 inches at the opening, sometimes 5 feet deep and 30 feet long with more than 1 entrance. Woodchucks have one litter a year that ranges from 2-6 young. The off-spring breed at age 1 and live 4-5 years. If a pair of woodchucks and their offspring all survived to breed as soon as possible, with an average litter size of 4 with a 1:1 sex ratio; they could produce over 645 woodchucks through their life time. No population data or density information was available for woodchucks in Maryland.

Woodchucks are found throughout Maryland and are classified by the MDNR as an "unprotected mammal." As such there are no closed seasons or bag limits for woodchucks.

It is anticipated that no more than approximately 100 woodchucks will be lethally taken on BWI airport and adjacent properties each year. Based on the above information and WS limited lethal take of woodchucks on BWI airport and adjacent properties, the WS WDM program should have minimal effects on local and statewide woodchuck populations. This is supported by the MDNR, which is the agency with responsibility for managing wildlife in the State (Annotated Code of MD, Natural Resources 10-202, 10-206, 10-901, 10-908).

Rodents Population Impacts

Rodents such as rats, feral mice, voles, and white-footed mice are common prey species found on airports, which in turn attract raptors to the airport environments. Any direct control for such rodents would be done to help prevent raptors from hunting near runways and taxiways. Impacts to such rodents would be minimal because any rodent control would be localized within the airport perimeters, and is supported by the high reproductive rate of these rodents (Mumford 1982).

Other Target Bird and Mammal Species Population Impacts

Target wildlife species, in addition to those analyzed above could be killed by WS in small numbers (less than 30 individuals per year per species).

Migratory birds are protected by the USFWS under the Migratory Bird Treaty Act and the take is limited by permit. The USFWS, as the agency with management responsibility, could impose restrictions on depredation harvest as needed to assure cumulative take does not adversely affect the continued viability of populations. This should assure that cumulative impacts on migratory bird populations would have no significant adverse impact on the quality of the human environment.

Mammals native to Maryland are protected by Maryland state law. The MDNR, as the agency with management responsibility, could impose restrictions on depredation harvest as needed to assure cumulative take does not adversely affect the continued viability of native mammal populations. This should assure that cumulative impacts on mammal populations would have no significant adverse impact on the quality of the human environment.

It is anticipated that no more than 30 individuals of a wildlife species not included in the above species specific analysis could be lethally taken on BWI airport and adjacent properties each year. Based upon the limited lethal take and USFWS and MDNR oversight, it is anticipated that none of these bird and mammal species are expected to be taken by WS at any level that would adversely affect their populations. This is supported by the MDNR, which is the agency with responsibility for managing wildlife in the State (Annotated Code of MD, Natural Resources 10-202, 10-206, 10-901, 10-908).

4.1.1.2 Alternative 2 – WS non-lethal WDM program only

Under this alternative, WS would not lethally take any target species and only non-lethal WDM activities and technical assistance recommendations would be made or implemented. Although WS take of target wildlife species would not occur, it is likely that, without WS conducting some level of lethal WDM activities, airport personnel or outside contractors WDM efforts would increase, leading to similar or greater impacts on target species populations as those of the current program alternative. For the same reasons shown in the population impacts analysis in section 4.1.1.1, it is unlikely that target wildlife populations would be adversely affected by implementation of this alternative.

4.1.1.3 Alternative 3 – WS lethal WDM program only

Under this alternative, WS would likely have a greater impact on the target species population than Alternative 1. Only lethal WDM activities would be implemented to resolve wildlife damage in all situations. WS would not recommended or use any non-lethal WDM activities to reduce wildlife damage at BWI airport. It is likely that a greater number of birds and mammals would likely have to be lethally removed to achieve the same results as the proposed action. However based upon the information described in section 4.1.1.1, it is unlikely that target species populations would be adversely affected by implementation of this alternative.

4.1.1.4 Alternative 4 -No WS WDM program

Under this alternative, WS would have no impact on target species populations. Increased airport personnel/contractors' efforts to reduce or prevent wildlife conflict could result in negative impacts on target species populations to an unknown degree. Impacts on target species under this alternative could be the same, less, or more than those of the proposed action, depending on the level of effort expended by airport personnel/contractors. However, it is unlikely that target wildlife populations would be adversely affected by implementation of this alternative.

4.1.2 Effects on Other Wildlife Species Populations, including T&E Species.

4.1.2.1 Alternative 1 – WS Integrated WDM program (Proposed Action/No Action)

Mitigation measures to avoid non-target and T&E species impacts are described in Chapter 3 (section 3.4.2.2).

Adverse Impacts on Non-target (non-T&E) Species. There has been no take of non-target species by WS while conducting WDM activities to reduce wildlife damage on BWI airport. Although it is possible that some non-target birds may be unknowingly killed by use of DRC-1339, the method of application is designed to minimize or eliminate that risk. For example, DRC-1339 treated bait is only applied after a period of prebaiting with untreated bait material and when non-target birds are not observed coming to feed at the site. WS take of non-target species during WDM activities is expected to be extremely low to non-existent. While every precaution is taken to safeguard against taking non-target species, at times changes in local animal movement patterns and other unanticipated events could result in the incidental take of unintended species. These occurrences are rare and should not affect the overall populations of any species under the current program.

T&E Species Impacts. WS has reviewed the list of T&E species for BWI airport and the surrounding area (Anne Arundel County). The following is a description of WS potential impacts to Federally and State listed species for this area.

Federally listed species
T&E species that are federally listed for Anne Arundel County, Maryland are:

Animals	
Bald eagle	*Haliaeetus leucocephalus*
Plants	
Sensitive joint-vetch	*Aeschynomene virginica*
Swamp pink	*Helonias bullata*
Chaffseed	*Schwalbea americana*

WS WDM activities at BWI airport and adjacent properties would not adversely affect the bald eagle. This determination is based on the conclusions made by the FWS during their 1992 programmatic consultation of WS activities and subsequent Biological Opinion (USDA 1997, Appendix F). The USFWS determined that the management activities being utilized for WS WDM at airports in Maryland are not likely to adversely affect the bald eagle. In addition, WS has determined that the use of WDM methods not included in the 1992 BO will have no effect on the bald eagle. Furthermore WS has determined that WDM methods used by WS will have no effect on any listed plant species.

State listed species
A list of State listed T&E species and species in Need of Conservation can be found in Appendix E. WS has determined that WS WDM activities at BWI airport and adjacent properties would not adversely affect any State listed T&E species and species in Need of Conservation. The MDNR concurs with WS not likely to adversely affect determination (Annotated Code of MD, Natural Resources 10-202, 10-2A-03, 10-2A-05).

DRC-1339 and Avitrol®. The inherent safety features of DRC-1339 and Avitrol® use that preclude or minimize hazards to mammals and plants are described in Appendix C and in a formal risk assessment in the ADC FEIS (USDA 1997, Appendix P). Those measures and characteristics should assure there would be no jeopardy to T&E species or adverse impacts on mammalian or non-T&E bird scavengers from the proposed action. DRC-1339 poses no primary hazard to eagles because eagles do not eat grain or other bait materials on which this chemical might be applied during WDM, and, further, because eagles are highly resistant to DRC-1339. Up to 100 mg doses were force fed to captive golden eagles with no mortality or adverse effects noted other than regurgitation and head-shaking (Larsen and Dietrich 1970). Secondary hazards to raptors from DRC-1339 and Avitrol® are low to nonexistent (see Appendix C). Therefore, WS use of these chemicals at BWI airport will have no adverse effects on bald eagles.

Other WDM Chemicals. Any operational uses of WDM chemicals would be in accordance with labeling requirements under FIFRA and state pesticide laws and regulations that are established to avoid unreasonable adverse effects on the environment. Following labeling requirements and use restrictions are a built-in mitigation measure that would assure that use of registered chemical products would avoid significant adverse effects on non-target species populations.

4.1.2.2 Alternative 2 – WS non-lethal WDM program only

Under this alternative, WS take of non-target animals would probably be less than that of the proposed action because WS would take no lethal control actions. However, non-target take would not differ substantially from the current program because the current program has taken no non-target animals. On the other hand, airports whose wildlife damage problems were not effectively resolved by non-lethal control methods and recommendations would likely resort to other means of lethal control such as use of

shooting by airport personnel/contractors. This could result in less experienced persons implementing control methods and could lead to greater take of non-target wildlife than the proposed action. For example, shooting by persons not proficient at bird identification could lead to killing of non-target birds.

4.1.2.3 Alternative 3 – WS lethal WDM program only

Under this alternative, only lethal WDM activities would be recommended and implemented to resolve wildlife conflicts in all situations. WS would not recommended or use any non-lethal WDM activities to reduce wildlife damage at BWI airport. WS take of non-targets would not differ substantially from the current program described in section 4.1.2.1. Since fewer WDM control methods would be available for use by WS, it would be more difficult to reduce wildlife conflicts to an acceptable level. This could lead to non-WS personnel implementing less selective WDM control methods. Technical support would lead to more appropriate use of lethal control methods by non-WS personnel. However, airport personnel/contractor efforts to reduce or prevent damage could still result in less experienced persons implementing control methods which could lead to greater take of non-target wildlife than under the proposed action.

4.1.2.4 Alternative 4 - No WS WDM program

Alternative 4 would not allow any WS WDM at BWI airport. There would be no impact on non-target or T&E species by WS WDM activities from this alternative. However, airport personnel/contractor efforts to reduce or prevent conflicts could result in less experienced persons implementing control methods which could lead to greater take of non-target wildlife than under the proposed action. For example, shooting by persons not proficient at bird identification could result in the killing of non-target birds.

4.1.3 Economic Losses to Property as a Result of Wildlife Damage

4.1.3.1 Alternative 1- WS Integrated WDM program (Proposed Action/No Action)

People are concerned with the economic costs associated with damage caused by wildlife to aircraft and other airport property. Wildlife can cause severe damage or total loss to aircraft, structural damage to aircraft hangers and buildings, damage to equipment and other property, obstruction and damage to water control structures, and damage to the perimeter security fencing. An Integrated WDM, a combination of lethal and non-lethal means, has the greatest potential of successfully reducing the risk of wildlife damage. All WDM methods could possibly be implemented and recommended by WS.

4.1.3.2 Alternative 2 – WS non-lethal WDM program only

Under this alternative, WS would be restricted to implementing and recommending only non-lethal WDM methods. Wildlife damage could increase under this alternative if non-lethal techniques were ineffective. Airport operations personnel requesting WDM assistance to reduce wildlife damage would not be provided information or services in lethal control. If non-lethal methods did not reduce or eliminate the wildlife damage, no other WS options would be available. Airport personnel/contractors would then be required to develop and implement their own lethal program. The success of this non-WS program would be dependent upon the expertise of the personnel involved and therefore could be less effective than a WS WDM program. Therefore, wildlife damage to property could remain the same or be greater than the proposed action.

4.1.3.3 Alternative 3 - WS lethal WDM program only

Under this alternative, only lethal WDM activities would be implemented or recommended to resolve wildlife damage conflicts. Toxicants, trapping, and shooting would be available for use or recommendation; however, due to safety considerations and airport regulations all lethal WDM methods may not be available for use in all situations. In those areas where lethal WDM could not be conducted, such as areas on an airfield where discharge of firearms is not safe or allowed, wildlife damage would not be reduced. In these situations, WS would not be able to recommend or use non-lethal methods that would otherwise be available under the

proposed action. If airport personnel/contractor did not implement their own non-lethal program in this particular situation, wildlife damage would continue to occur. Therefore, wildlife damage to property could remain the same or be greater than the proposed action.

4.1.3.4 Alternative 4 - No WS WDM program

With no WS assistance, airport personnel/contractor would be responsible for developing and implementing their own WDM program. Wildlife damage to property could be greater under this alternative than the proposed action dependent upon the skills and abilities of the person implementing WDM control methods. Airport efforts to reduce or prevent conflicts could result in less experienced persons implementing control methods. This could result in a greater potential for wildlife property damage to continue or possibly increase above current levels.

4.1.4 Effects on Human Health and Safety

4.1.4.1 Safety and Efficacy of chemical control methods

4.1.4.1.1 Alternative 1 – WS Integrated WDM program (Proposed Action/No Action)

Following labeling requirements and use restrictions are a built-in mitigation measure that would assure that use of registered chemical products would avoid adverse effects on human health. Based on a thorough Risk Assessment, APHIS concluded that, when WS program chemical methods are used in accordance with label directions, they are highly selective to target individuals or populations, and such use has negligible impacts on the environment (USDA 1997).

DRC-1339 (3-chloro-p-toluidine hydrochloride). DRC-1339 is the primary lethal chemical method that would be used under the current program alternative for lethal bird control. There has been some concern expressed by a few members of the public that unknown but significant risks to human health may exist from DRC-1339 used for WDM.

This chemical is one of the most extensively researched and evaluated pesticides ever developed. Over 30 years of studies have demonstrated the safety and efficacy of this compound. Appendix C provides more detailed information on this chemical and its use in BDM. Factors that virtually eliminate any risk of public health problems from use of this chemical are:

- Its use is prohibited within 50 feet of standing water and cannot be applied directly to food or feed crops.
- DRC-1339 is highly unstable and degrades rapidly when exposed to sunlight, heat, or ultraviolet radiation. The half-life is about 25 hours, which means that treated bait material generally is nearly 100% broken down within a week.
- It is more than 90% metabolized in target birds within the first few hours after they consume the bait. Therefore, little material is left in bird carcasses that may be found or retrieved by people.
- Application rates are extremely low (less than 0.1 lb. of active ingredient per acre) (EPA 1995).
- A human would need to ingest the internal organs of birds found dead from DRC-1339 to have any chance of receiving even a minute amount of the chemical or its metabolites into his/her system. This is highly unlikely to occur.
- The EPA has concluded that, based on mutagenicity (the tendency to cause gene mutations in cells) studies, this chemical is not a mutagen or a carcinogen (i.e., cancer-causing agent)

(EPA 1995). Regardless, however, the extremely controlled and limited circumstances in which DRC-1339 is used would prevent any exposure of the public to this chemical.

The above analysis indicates that human health risks from DRC-1339 use would be virtually nonexistent under any alternative.

Avitrol® (4-Aminopyridine). Avitrol® is another chemical method that might be used by WS for bird control. Appendix C provides more detailed information on this chemical.
Avitrol® is available as a prepared grain bait mixture that is mixed in with clean bait at no greater than a 1:9 treated to untreated mixture. In addition to this factor, other factors that virtually eliminate health risks to members of the public from use of this product as an avicide are:

- It is readily broken down or metabolized into removable compounds that are excreted in urine in the target species (ETOXNET 1996). Therefore, little of the chemical remains in killed birds to present a hazard to humans.

- A human would need to ingest the internal organs of birds found dead from Avitrol® ingestion to have any chance of receiving even a minute amount of the chemical or its metabolites into his/her system. This is highly unlikely to occur. Furthermore, secondary hazard studies with mammals and birds have shown that there is virtually no hazard of secondary poisoning.

- Although Avitrol® has not been specifically tested as a cancer-causing agent, the chemical was found not to be mutagenic in bacterial organisms (EPA 1997). Therefore, the best scientific information available indicates it is not a carcinogen. Regardless, however, the extremely controlled and limited circumstances in which Avitrol® is used would prevent exposure of members of the public to this chemical.

The above analysis indicates that human health risks from Avitrol® use would be virtually nonexistent under any alternative.

Rodenticides. Several anticoagulant rodenticides are used to control commensal rodents and some field rodents around building and other structures. Common anticoagulants include warfarin and diphacinone. Anticoagulants are normally classified s multiple-dose toxicants. For the materials to be effective, animals must feed on the bait more than once. However, some newer formulations only require a single feeding to effective. Bair for rats and mice must be continuously available for 2 to 3 weeks for effective population control.

Zinc phosphide is a metallic toxicant most often used for rat, vole, muskrat, and nutria damage control. The odor of zinc phosphide is attractive to rodents by repulsive to most other animals. Tarter emetic is sometimes added to baits used to control rats. This safety feature will cause most other species to regurgitate any zinc phosphide baits they may consume. Its effectiveness for rat control is not compromised because rats are unable to regurgitate.

Gas Cartridges are placed in burrows/dens and are burned to create carbon monoxide gas to euthanize animals. Applicators must exercise caution to avoid burns to the skin or surrounding vegetation.

Other WDM Chemicals. Other non-lethal WDM chemicals that might be used or recommended by WS include repellents such as methyl anthranilate (artificial grape flavoring used in foods and soft drinks sold for human consumption), Flight Control®, which is used as an area repellent, and the tranquilizer drug Alpha-chloralose. Such chemicals must undergo rigorous testing and research to prove safety, effectiveness, and low environmental risks before EPA or FDA would register them. Any operational uses of chemical repellents would be in accordance with labeling requirements under FIFRA and state pesticide laws and regulations that are established to avoid unreasonable adverse effects on the environment. Following labeling

requirements and use restrictions are a built-in mitigation measure that would assure that use of registered chemical products would avoid significant adverse effects on human health and safety.

4.1.4.1.2 Alternative 2 – WS non-lethal WDM program only

Under this alternative WS could only implement or recommend non-lethal methods such as Avitrol®, the tranquilizer drug Alpha-chloralose and chemical repellents such as methyl anthranilate. Such chemicals must undergo rigorous testing and research to prove safety, effectiveness, and low environmental risks before EPA or FDA registers them. Any operational use of chemical pesticides and repellents would be in accordance with labeling requirements under FIFRA and state pesticide laws and regulations and FDA rules, which are established to avoid unreasonable adverse effects on the environment. Following labeling requirements and use restrictions are a built-in mitigation measure that would assure that use of registered chemical products would avoid adverse effects on human health. The effects of WS's use of non-lethal chemical WDM methods would not differ substantially from the proposed action.

4.1.4.1.3 Alternative 3 - WS lethal WDM program only

Under this alternative WS could only implement or recommend lethal WDM methods such as DRC-1339, rodenticides, zinc phosphide, and gas cartridges. The effects of WS's use of lethal chemical WDM methods would not differ substantially from the proposed action.

4.1.4.1.4 Alternative 4 - No WS WDM program

Concerns about human health risks from WS's use of chemical WDM methods would be alleviated because no such use would occur. DRC-1339 and Alpha-Chloralose are only registered for use by WS personnel, and would not be available for use by airport personnel or government contractors. Commercial pest control services would be able to use Avitrol® and such use would likely occur to a greater extent in the absence of WS's assistance. However, use of Avitrol® in accordance with label requirements should avoid any hazard to members of the public.

4.1.4.2 Impacts on human safety of non-chemical WDM methods

4.1.4.2.1 Alternative 1 – WS Integrated WDM program (Proposed Action/No Action)

Non-chemical WDM methods that might raise safety concerns include shooting with firearms, use of traps and snares, and harassment with pyrotechnics. WS personnel receive safety training on a periodic basis to assure that WS personnel are aware of safety concerns associated with specific WDM methods. Firearms and pyrotechnics are only used by WS personnel who are experienced in handling and using them. WS traps are strategically placed to minimize exposure to humans and pets. Body-grip (i.e. Conibear) traps for beaver and muskrats are restricted to water sets, which further reduces threats to public and pet health and safety. The MD WS program has had no accidents involving the use of firearms, traps, or pyrotechnics in which a member of the public was harmed. A formal risk assessment of WS's operational WDM methods found that risks to human safety were low (USDA 1997, Appendix P). Therefore, no adverse impacts on human safety from WS's use of non-chemical WDM methods are expected.

4.1.4.2.2 Alternative 2- WS non-lethal WDM program only

Under this alternative, WS would not use firearms for lethal control during WDM but would still be able to use them as a harassment method. WS would also use pyrotechnics. Risks to human safety from WS's use of firearms and pyrotechnics would be similar to the current program alternative. However since WS will not be providing lethal WDM assistance, an increase in the use of lethal WDM methods by less experienced and trained individuals may occur resulting in an increased risk to human safety.

4.1.4.2.3 Alternative 3 – WS lethal WDM program only

WS's use of non-chemical lethal WDM methods would not differ substantially from the program described in Alternative 1. However an increase in the use of pyrotechnics by non-WS personnel would occur since WS would not be able to use or recommend pyrotechnics under this alternative. Risks to human safety resulting from the use of pyrotechnics by non-WS personnel could increase or remain about the same as the proposed action dependent upon the skills and abilities of the person using this harassment device.

4.1.4.2.4 Alternative 4 - No WS WDM program

Under this alternative, WS would not engage in or recommend use of any non-chemical WDM methods. Risks to human safety from WS's use of firearms, traps, snares, and pyrotechnics would hypothetically be lower than the current program alternative. However, increased use of firearms, traps, snares, and pyrotechnics by less experienced and trained private individuals would probably occur without WS assistance. Risks to human safety under this alternative could increase or remain about the same as the proposed action dependent upon the skills and abilities of the person implementing specific WDM methods.

4.1.4.3 Impacts on human safety from Wildlife strike hazards to aircraft

4.1.4.3.1 Alternative 1 - WS Integrated WDM program (Proposed Action/No Action)

People are concerned with potential injury and loss of human life as a result of wildlife/aircraft collisions. An Integrated WDM strategy, a combination of lethal and non-lethal means, has the greatest potential of successfully reducing the risk of wildlife aircraft strikes. All WDM methods could possibly be implemented and recommended by WS.

4.1.4.3.2 Alternative 2 – WS non-lethal WDM program only

Under this alternative, only non-lethal WDM methods would be used or recommended by WS. Wildlife strikes could increase under this alternative if non-lethal techniques were ineffective. Airport personnel requesting WDM assistance to reduce wildlife strikes would not be provided information or services in lethal control. If non-lethal methods did not reduce or eliminate the wildlife hazard, no WS options would be available. Airport personnel would then be required to implement their own lethal program with success, dependent upon the expertise of the personnel involved. Therefore wildlife strike hazards could be greater than the proposed action.

4.1.4.3.3 Alternative 3 - WS lethal WDM program only

Under this alternative, only lethal WDM activities would be implemented or recommended by WS. Due to safety considerations and airport regulations all lethal WDM methods would not be available for use in all situations. In areas where lethal WDM could not be conducted, such as areas on the airfield where discharge of firearms is not safe or allowed, wildlife strikes would not be reduced. In these situations WS would not be able to recommend or use non-lethal methods that otherwise would be available under the proposed action. If airport personnel did not implement their own non-lethal program in this particular situation wildlife strikes remaining would remain the same or possibly increase. Therefore wildlife strike hazards could be greater under this alternative than the proposed action.

4.1.4.3.4 Alternative 4 - No WS WDM program

With no WS assistance, airport personnel would be responsible for developing and implementing their own WDM program. Airport efforts to reduce or prevent conflicts could result in less experienced persons implementing control methods, therefore leading to a greater potential of not reducing wildlife strikes than the proposed action.

4.1.5 Effects on Aesthetics

4.1.5.1 Effects on Human Affectionate-Bonds with Individual Animals and on Aesthetic Values of Wildlife Species

4.1.5.1.1 Alternative 1 - WS Integrated WDM program (Proposed Action/No Action)

Some people who routinely view or feed individual birds and mammals such as geese and deer would likely be disturbed by removal of such animals under the current program. Some people have expressed opposition to the killing of any animal during WDM activities. Under the current program, some lethal control of wildlife would continue and these persons would continue to be opposed. However, many persons who voice opposition has no direct connection or opportunity to view or enjoy the particular animals that would be killed by WS's lethal control activities. Lethal control actions would generally be restricted to local sites and to small, insubstantial percentages of overall populations. Therefore, the species subjected to limited lethal control actions would remain common and abundant and would therefore continue to remain available for viewing by persons with that interest.

Some people do not believe that wildlife or bird roosts should even be harassed to stop or reduce damage problems. Some people who enjoy viewing wildlife would feel their interests are harmed by WS's non-lethal harassment program. Mitigating that impact, however, is the fact that a harassment program does not diminish overall numbers of wild animals in the area. People who like to view these species can still do so on State wildlife management areas, as well as numerous private property sites where the owners are not experiencing damage from wild birds and mammals and are tolerant of their presence.

4.1.5.1.2 Alternative 2 – WS non-lethal WDM program only

Under this alternative, WS would not conduct any lethal WDM but would still conduct harassment of wildlife that was causing damage. Some people who oppose lethal control of wildlife by government but are tolerant of government involvement in non-lethal wildlife damage management would favor this alternative.

Some people do not believe that wildlife or bird roosts should even be harassed to stop or reduce damage problems. Some people who enjoy viewing wildlife would feel their interests are harmed by WS's non-lethal harassment program. Mitigating that impact, however, is the fact that a harassment program does not diminish overall numbers of wild animals in the area. People who like to view these species can still do so on State wildlife management areas, as well as numerous private property sites where the owners are not experiencing damage from wild birds and mammals and are tolerant of their presence.

Persons who have developed affectionate bonds with individual wild birds and mammals would not be affected by WS's lethal WDM activities under this alternative because WS would not kill the individual animal(s). However, airport personnel would likely conduct lethal WDM activities that would no longer be conducted by WS. Therefore the impacts of this alternative would be similar to the proposed action.

4.1.5.1.3 Alternative 3 - WS lethal WDM program only

Under this alternative, only lethal WDM activities would be implemented or recommended. People that have expressed opposition to the killing of any bird or mammal during WDM activities would likely be opposed to this alternative. Non-lethal methods would not be used or recommended by WS, therefore impacts of this alternative would be greater than the propose action.

4.1.5.1.4 Alternative 4 - No WS WDM program

Under this alternative, WS would not conduct any lethal or non-lethal WDM activities. Some people who oppose any government involvement in wildlife damage management would favor this alternative. Persons who have developed affectionate bonds with individual wild birds and mammals would not be affected by WS's activities under this alternative. However, airport personnel/contractors would likely conduct similar WDM activities as those that would no longer be conducted by WS, resulting in impacts similar to the current program alternative.

4.1.5.2 Effects on Aesthetic Values of Property Damaged by Wildlife

4.1.5.2.1 Alternative 1 - WS Integrated WDM program (Proposed Action/No Action)

Under this alternative, WS would provide operational and technical assistance in reducing bird problems in which droppings are causing an unsightly mess and would, if successful, improve aesthetic values. All WDM methods would be available for use, including the use of DRC-1339 and Alpha-chloralose. Relocation of nuisance roosting birds by harassment can sometimes result in the birds causing the same or similar problems at the new location. If WS is providing direct operational assistance in relocating such birds, coordination with local authorities to monitor the birds' movements is generally conducted to assure they do not reestablish in other undesirable locations.

4.1.5.2.2 Alternative 2 – WS non-lethal WDM program only

Under this alternative, WS would only provide non-lethal operational and technical assistance to reduce problems in which droppings from birds have caused an unsightly mess and would, if successful, improve aesthetic values. Relocation of nuisance roosting birds by harassment can sometimes result in the birds causing the same or similar problems at the new location. If WS is providing direct operational assistance in relocating such birds, coordination with local authorities to monitor the birds' movements are generally conducted to assure they do not reestablish in other undesirable locations.

If non-lethal WDM methods were not effective in reducing wildlife problems, WS would not be able to recommend or implement any lethal WDM method. Airport personnel would then have the option of doing nothing, which would not reduce the problem, or implement their own control methods, which can have varying success dependent upon the skills and abilities of the person implementing specific WDM methods. Overall, impacts of improving aesthetics would be less than the proposed action.

4.1.5.2.3 Alternative 3 - WS lethal WDM program only

Under this alternative, only lethal WDM activities would be implemented or recommended. This alternative would result in nuisance wildlife being removed by lethal means only. Where lethal WDM could be conducted, wildlife damage would likely be reduced to acceptable levels. In areas where lethal WDM could not be conducted, such as areas on the airfield where discharge of firearms is not safe or allowed, wildlife damage would not be reduced. Airport personnel would be required to develop and implement their own non-lethal WDM programs. Relocation of nuisance wildlife or bird roosts through harassment, barriers, or habitat alteration can sometimes result in causing the same problems at the new location. If WS does not provided non-lethal assistance to airport personnel, coordination with local authorities to monitor bird and wildlife movements to assure they do not reestablish in other undesirable locations might not be conducted. Overall, impacts of improving aesthetics would be less than the proposed action.

4.1.5.2.4 Alternative 4 - No WS WDM program

Under this alternative, WS would not provide any operational or technical assistance in reducing wildlife problems. Aesthetic values would continue to be adversely affected if airport personnel were not able to implement there own WDM, or reduce damage in some other way.

4.1.6 Humaneness and Animal Welfare Concerns of Lethal Methods Used by WS

4.1.6.1 Alternative 1 – WS Integrated WDM program (Proposed Action/No Action)

Under this alternative, methods viewed by some persons as inhumane would continue to be used in WDM by WS. These methods would include shooting, trapping and toxicants/chemicals such as DRC-1339 and Avitrol.

Shooting, when performed by experienced professionals, usually results in a quick death for target animals. Occasionally, however, some birds and mammals are initially wounded and must be shot a second time or must be caught by hand and then dispatched or euthanized. Some persons would view shooting as inhumane.

Despite SOP's designed to maximize humaneness, as described in sections 3.4.1, the perceived stress and trauma associated with being held in leghold traps or snares until the WS specialist arrives to euthanize the animal, is unacceptable to some persons. Other lethal WDM methods used to take target animals include body-gripping traps (i.e., snap traps and Conibears). These traps result in a relatively humane death because the animals die instantly or within seconds to a few minutes.

Research suggests that with some methods, such as restraint in leghold traps, changes in the blood chemistry of trapped animals indicate "stress." Blood measurements indicated similar changes in foxes that had been chased by dogs for about five minutes as those restrained in traps (USDA 1997j). However, such research has not yet progressed to the development of objective, quantitative measurements of pain or stress for use in evaluating humaneness. The challenge in coping with this issue is how to achieve the least amount of animal suffering with the constraints imposed by current technology. To insure the most professional handling of these issues and concerns, APHIS-WS has policies giving direction toward the achievement of the most humane program possible while still accomplishing the program's mission.

The primary lethal chemical WDM method that would be used by WS under this alternative would be DRC-1339. This chemical causes a quiet and apparently painless death that results from uremic poisoning and congestion of major organs (Decino et al. 1966). The birds become listless and lethargic, and a quiet death normally occurs in 24 to 72 hours following ingestion. This method appears to result in a less stressful death than which probably occurs by most natural causes; which are primarily disease, starvation, and predation. For these reasons, WS considers DRC-1339 use under the current program to be a relatively humane method of lethal WDM. However, despite the apparent painlessness of the effects of this chemical, some persons will view any method that takes a number of hours to cause death as inhumane and unacceptable.

The chemical Avitrol repels birds by poisoning a few members of a flock, causing them to become hyperactive (see discussion in Appendix C). Their distress calls generally alarm the other birds and cause them to leave the site. Only a small number of birds need to be affected to cause alarm in the rest of the flock. The affected birds generally die. Some persons would view Avitrol as inhumane treatment of the affected birds, based on the birds' distress behaviors.

The primary lethal small mammal chemical WDM method that would be used by WS under this alternative would be rodenticides. Although it is difficult to develop objective quantitative measurements of pain or stress, rodents affected by these chemicals rarely display any evidence of pain. The rodents usually become listless and lethargic, and a quiet death normally occurs in 48 to 72 hours following ingestion. This method appears to result in a less stressful death than that which probably occurs by most natural causes; which are primarily disease, starvation, and predation. For these reasons, WS considers rodenticide use under the current program to be a relatively humane method of lethal WDM. However, despite the apparent painlessness of the effects of these chemicals, some persons will view any method that takes a number of hours to cause death as inhumane and unacceptable.

The gas cartridge is used to lethally remove underground denning mammals such as woodchucks. The gas cartridge when ignited releases CO_2 gas into the den of the target species. CO_2 gas is a AVMA-approved euthanasia methods (Beaver et al. 2001). Most people would view AVMA-approved euthanization methods as humane.

Occasionally, birds captured alive by traps, by hand or with nets would be euthanized. The most common method of euthanization would be cervical dislocation and by CO_2 gas which are AVMA-approved

euthanasia methods (Beaver et al. 2001). Most people would view AVMA-approved euthanization methods as humane.

APHIS-WS has improved the selectivity of management devices through research and development of pan-tension devices and other device modifications such as breakaway snares. Research is continuing with the goal of bringing new findings and products into practical use. Until such time as new findings and products are found to be practical, some animal suffering may occur when lethal WDM methods are used.

4.1.6.2 Alternative 2 – WS non-lethal WDM program only

Under this alternative, WS would not use lethal methods viewed as inhumane by some persons. However, airport personnel would likely use those lethal methods that are no longer available to WS resulting in impacts to similar to or greater than the proposed action depending upon the skills and abilities of the non-WS personnel implementing specific WDM methods. Since DRC-1339 would not be available to non-WS entities, the only chemical bird WDM method that could be legally would be Avitrol®. Avitrol® would most likely be viewed as less humane than DRC-1339 because of the distress behaviors that it causes. People who perceive the use of lethal control methods by WS as inhumane would prefer this alternative to the proposed action.

4.1.6.3 Alternative 3 - WS lethal WDM program only

Under this alternative, only lethal WDM activities would be implemented or recommended by WS. These methods would include shooting, trapping, snares, and the use of toxicants/chemicals and may be viewed by some persons as inhumane. Impacts for this alternative would be similar to the proposed action.

4.1.6.4 Alternative 4 - No WS WDM program

Under this alternative, lethal methods viewed as inhumane by some persons would not be used or recommended by WS. Similar to Alternative 2, DRC-1339 would no longer be available for use. Thus, the only chemical bird WDM method legally available would be Avitrol® which would be viewed by many persons as less humane than DRC-1339. Overall, it is likely that lethal WDM methods used by non-WS personnel would be similar to Alternative 2.

4.2 Cumulative Impacts

No significant cumulative environmental impacts are expected from any of the 4 alternatives. Under the Proposed Action and Alternative 3, the lethal removal of wildlife would not have a significant impact on overall wild bird and mammal populations in Maryland, but some local reductions may occur. This is supported by the MDNR, which is the agency with responsibility for managing wildlife in the State (Annotated Code of MD, Natural Resources 10-202, 10-206). No risk to public safety is expected when WS' services are provided and accepted by requesting individuals in Alternatives 1, 2, and 3, since only trained and experienced wildlife specialists would conduct and recommend WDM activities. There is a slight increased risk to public safety when persons who reject WS assistance and recommendations in Alternatives 1, 2 and 3 conduct WDM activities, and when no WS assistance is provided in Alternative 4. In all 4 Alternatives, however, it would not be to the point that the impacts would be significant. Although some persons will likely be opposed to WS' participation in WDM activities to protect property and human health and safety at BWI airport, the analysis in this EA indicates that WS Integrated WDM program will not result in significant cumulative adverse impacts on the quality of the human environment.

Table 4-2 Summary of the expected impact of each of the alternatives on each of the issues.

Issues/Methods	Alternative 1 – WS Integrated WDM program (Proposed Action/No Action)	Alternative 2 – WS non-lethal WDM program only	Alternative 3 - WS lethal WDM program only	Alternative 4 - No WS WDM program
Effects on Target Wildlife Species Populations	Local populations in areas with damage or threat of damage would be reduce and sustained at a lower level. No effects on state populations.	WS would have no effect on wildlife populations. Results may equal or be less than the proposed action dependent upon actions taken by non-WS personnel.	Local populations in areas with damage or threat of damage would be reduced and sustained at a lower level. No effects on state populations	WS would have no effect on wildlife populations. If airport personnel conduct their own management without WS, results could be similar or greater than the proposed action.
Effects on other Wildlife Species Populations, including T&E Species	No adverse effect.	No adverse effect. If airport personnel conduct lethal removal without WS, there is an increased possibility that non-targets species maybe taken.	No adverse effect.	No impact by WS. If airport personnel conduct lethal removal without WS, there is an increased possibility that non-targets species maybe taken.
Economic Losses to Property as a Result of Wildlife Damage	The proposed action has the greatest potential of successfully reducing this risk.	There is a greater potential of not reducing wildlife property damage than the proposed action.	There is a greater potential of not reducing wildlife property damage than the proposed action.	There is a greater potential of not reducing wildlife property damage than the proposed action.
Effects on Human Health and Safety	The proposed action has the greatest potential of successfully reducing this risk. No adverse affects from WS use of WDM control methods.	There is a greater potential of not reducing threats to human health and safety than the proposed action. No adverse affects from WS use of WDM control methods.	There is a greater potential of not reducing threats to human health and safety than the proposed action. No adverse affects from WS use of WDM control methods.	There is a greater potential of not reducing threats to human health and safety than the proposed action. No impact from WS use of WDM control methods.
Effects on Aesthetics	Variable. Those people adversely affected by wildlife damage would favor this alternative. Some people would oppose this alternative.	Variable. Some people would favor this alternative since WS would not be using lethal control methods.	Variable. Some people would likely oppose this alternative since WS would be using lethal control methods.	No impact by WS. Airport personnel would likely conduct WDM activities no longer conducted by WS resulting in impacts similar to the proposed program.

Issues/Methods	Alternative 1 – WS Integrated WDM program (Proposed Action/No Action)	Alternative 2 – WS non-lethal WDM program only	Alternative 3 - WS lethal WDM program only	Alternative 4 - No WS WDM program
Humaneness and Animal Welfare Concerns of Lethal Methods Used by WS	Some people will view as inhumane. Others will view as more humane than alternative 3. Most people would view AVMA approved euthanization methods as humane.	People who perceive the use of lethal control methods by WS as inhumane would prefer this alternative to the proposed action.	Impacts for this alternative would be similar to the proposed action.	No impact by WS. Airports would likely implement lethal WDM methods resulting in impacts similar to or somewhat less humane than the proposed action.

Appendix A

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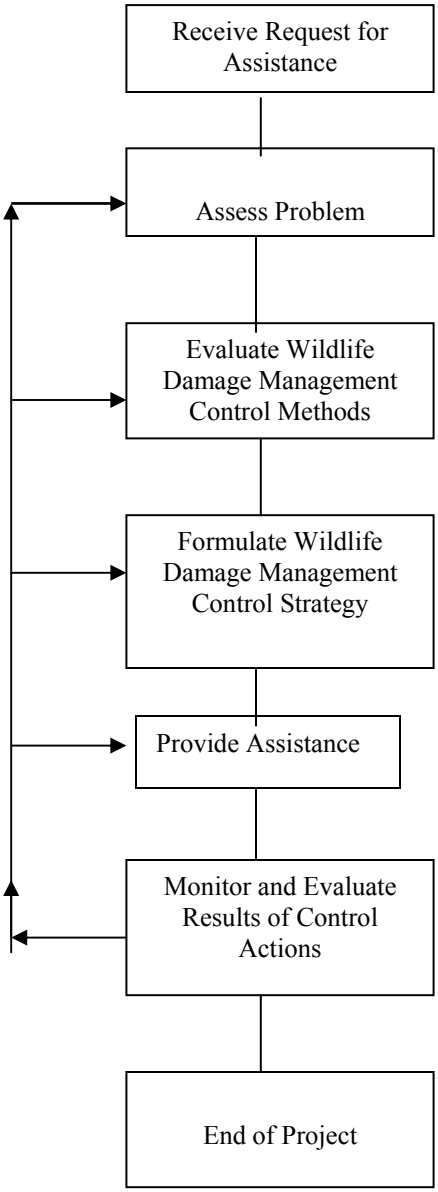
Appendix B

Wildlife Services Decision Model



Appendix C

WILDLIFE DAMAGE MANAGEMENT (WDM) METHODS AVAILABLE FOR USE OR RECOMMENDATIONS BY THE USDA/WILDLIFE SERVICES PROGRAM

NONLETHAL METHODS-NONCHEMICAL

Airfield management and property owner practices. These consist primarily of non-lethal preventive methods such as cultural methods and habitat modification. Airfield management or the property owner implements cultural methods and other management techniques. Resource owners/managers may be encouraged to use these methods, based on the level of risk, need, and professional judgment on their effectiveness and practically. These methods include:

Environmental/Habitat modification can be an integral part of WDM. Wildlife production and/or presence are directly related to the type, quality and quantity of suitable habitat. Therefore, habitat can be managed to reduce or eliminate the production or attraction of certain wildlife species. BWI airport is responsible for implementing habitat modifications, and WS only provides advice on the type of modifications that have the best chance of achieving the desired effect (FAA 2000). Habitat management is most often a primary component of WDM strategies at or near airports to reduce BASH problems by eliminating nesting, denning, roosting, loafing and feeding sites. Generally, many BASH problems on airport properties can be minimized through management of vegetation and water on areas adjacent to aircraft runways.

Animal Behavior Modification. This refers to tactics that alter the behavior of wildlife to reduce damage. Animal behavior modification may involve us of scare tactics or fencing to deter or repel animals that cause loss or damage (Twedt and Glahn 1982). Some but not all methods are included in this category are:

Wildlife fence (Physical Exclusion)
Bird-proof barriers
Propane cannons
Pryotechnics
Distress Calls and sound producing devices
Chemical frightening agents
Repellents
Harassment with a radio controlled plane
Mylar tape
Lasers

These methods are generally only practical for small area. Scaring devices such as distress calls, propane cannons, raptor effigies and silhouettes, mirrors and moving disks can be effective but usually for only a short time before birds become accustomed and learn to ignore them (Schmidt and Johnson 1984, Bomford 1990, Rossbach 1975, Graves and Andelt 1987, Mott 1985, Shirota et al. 1983, Conover 1982, Arhart 1972).

Wildlife Fence (Physical Exclusion) – A fence around the airfield could limit the entry of mammals onto the runway and taxiways. There are several types of fences that inhibit the movement of mammals onto the airfield area if properly installed including electric fencing, woven wire, and chain link fencing.

Bird-proof barriers can be effective but often are cost-prohibitive, particularly because of the aerial mobility of, which requires overhead barriers as well as peripheral fencing or netting. Building, hangers and display planes could be "bird proofed" using hardware cloth or netting, where feasible, to eliminate roosting and nesting areas. Porcupine wire (e.g., Nixalite™, Catclaw™) is a mechanical repellent method that can be used to exclude pigeons and other bird from ledges and other roosting surfaces (Williams and Coorigan 1994). The sharp points inflict temporary discomfort on the birds as they try to land, which deters them from roosting. Drawbacks of this method

are that some pigeons have been know to build nests on top of porcupine wires and the method can be expensive to implement if large areas are involved. Electric shock bird control systems are available from commercial sources and, although expensive, can be effective in deterring pigeons and other birds from roosting on ledges, window sills and other similar portions of structures (Williams and Corrigan 1994).

Auditory scaring devices such as propane cannons, pyrotechnics, electronic guards, sirens, scarecrows, and audio distress/predator vocalizations are effective in many situations for dispersing damage-causing bird species. These devices are sometimes effective but usually only for a short period of time before birds become accustomed and learn to ignore them (Schmidt and Johnson 1984, Bomford 1990, Rossbach 1975, Mott 1985, Shirota et.al. 1983, and Arhart 1972). These methods should be reinforced with other scaring devices such as shooting and other types of physical harassment.

Visual techniques such as use of mylar tape (highly reflective surface produces flashes of light that startles birds), eye-spot balloons (the large eyes supposedly gives birds a visual cue that a large predator is present), flags, effigies (scarecrows), sometimes are effective in reducing bird damage. Mylar tape has produced mixed results in its effectiveness to frighten birds (Dolbeer et.al 1986, and Tobin et.al. 1998). Birds quickly learn to ignore visual and other scaring devices if the birds' fear of the methods is not reinforced with shooting or other tactics.

Physical harassment by radio controlled airplanes are effective in several situations for dispersing damage-causing birds. This tool is effective in removing raptors from areas that are not accessible by other means. Radio controlled airplanes allow for up close and personal harassment of birds, while combining visual (eyespots painted on the wings) and auditory (engine noise and whistles attached to the aircraft) scare devices. Disadvantages of method are birds in large flocks do not respond to well the plane, training is required to become efficient, a good working relationship is required by the operator and air traffic controllers, weather conditions may restrict the ability/usefulness of the plane, and mechanical up keep.

Relocation of damaging birds or mammals to other areas following live capture generally would not be effective or cost-effective. Relocation to other areas following live capture would not generally be effective because problem bird species are highly mobile and can easily return to damage sites from long distances, habitats in other areas are generally already occupied, and relocation would most likely result in bird damage problems at the new location. Translocation of wildlife is also discouraged by WS policy (WS Directive 2.501) because of stress to the relocated animal, poor survival rates, and difficulties in adapting to new locations or habitats.

However, there may be exceptions for the relocation of certain damaging bird species. Relocation may be a viable solution and acceptable to the public when specific bird species are considered to have high value such as raptors, or T&E species. In these cases, WS would consult with the USFWS and/or MDNR to coordinate capture, transportation, and selection of suitable relocation sites, as well as compliance with all proper guidelines.

Lasers are a non-lethal technique recently evaluated by the USDA, APHIS, WS, National Wildlife Research Center (NWRC) to disperse double-crested cormorant roosts (Glahn et al. 2000). For best results and to disperse numerous birds from a roost, the laser is most effectively used in periods of low light, such as after sunset and before sunrise. In the daytime, the laser can also be used during overcast conditions or in shaded areas to move individual and small numbers of birds, although the effective range of the laser is much diminished. Moving the laser light through the tree branches rather than touching birds with the laser light elicited an avoidance response from cormorants (Glahn et al. 2000). During pen trials with lasers the cormorants were inconsistent in their response with some birds showing no response to the laser (Glahn et al. 2000). The lack of overt response by cormorants to lasers is not clearly understood, but suggests laser light is not an highly aversive agent (Glahn et al. 2000). Blackwell et al. (2002) tested lasers on several bird species and observed varied results among species. Lasers were ineffective at dispersing pigeons and mallard with birds habituating in approximately 5 minutes and 20 minutes, respectively (Blackwell et al. 2002). Canada geese reacted to the laser displaying neophobic avoidance to the approaching laser beam.

Vultures respond readily to lasers. In Florida, a roost of over 250 vultures in a residential neighborhood was dispersed after a laser was used there during 4 consecutive evenings. No habituation to the laser was noted. However, the birds returned 2 days later after laser harassment had ceased (M. Avery, NWRC, pers. commun.). At

three other roosts, similar short-term responses were observed. It appears that lasers can provide short-term vulture control, but there long-term effectiveness remains to be determined. As with other BDM tools, lasers are best viewed as components of an integrated management effort.

Nest destruction is the removal of nesting materials during the construction phase of the nesting cycle. Nest destruction is generally only applied when dealing with a single bird or very few birds. This method is used to discourage birds from constructing nests in areas which may create nuisances for home and business owners. Heusmann and Bellville (1978) reported that nest removal was an effective but time-consuming method because problem bird species are highly mobile and can easily return to damage sites from long distances, or because of high populations. This method poses no imminent danger to pets or the public.

Egg addling/destruction is a method of suppressing reproduction in local nuisance bird populations by destroying egg embryos prior to hatching. Egg addling is conducted by vigorously shaking an egg numerous times which causes detachment of the embryo from the egg sac. Egg destruction can be accomplished in several different ways, but the most commonly used methods are manually gathering eggs and breaking them, or by oiling or spraying the eggs with a liquid which covers the entire egg and prevents the egg from obtaining oxygen (see *Egg oiling* below). Although WS does not commonly use egg addling or destruction, it is a valuable damage management tool and has shown to be effective.

Live traps include:

Clover, funnel, and common pigeon traps are enclosure traps made of nylon netting or hardware cloth and come in many different sizes and designs, depending on the species of birds being captured. The entrance of the traps also vary greatly from swinging-door, one-way door, funnel entrance, to tip-top sliding doors. Traps are baited with grains or other food material which attract the target birds. WS' standard procedure when conducting pigeon trapping operations is to ensure that an adequate supply of food and water is in the trap to sustain captured birds for several days. Active traps are checked daily, every other day, or as appropriate, to replenish bait and water and to remove captured birds.

Decoy traps are used by WS for preventive and corrective damage management. Decoy traps are similar in design to the Australian Crow Trap as reported by Johnson and Glahn (1994) and McCracken (1972). Live decoy birds of the same species that are being targeted are usually placed in the trap with sufficient food and water to assure their survival. Perches are configured in the trap to allow birds to roost above the ground and in a more natural position. Feeding behavior and calls of the decoy birds attract other birds which enter and become trapped themselves. Active decoy traps are monitored daily, every other day, or as appropriate, to remove and euthanize excess birds and to replenish bait and water. Decoy traps and other cage/live traps, as applied and used by WS, pose no danger to pets or the public and if a pet is accidentally captured in such traps, it can be released unharmed.

Mist nets are more commonly used for capturing small-sized birds such as house sparrows, finches, etc. but can be used to capture larger birds such as ducks and ring-neck pheasants or even smaller nuisance hawks and owls. It was introduced in to the United States in the 1950's from Asia and the Mediterranean where it was used to capture birds for the market (Day et al. 1980). The mist net is a fine black silk or nylon net usually 3 to 10 feet wide and 25 to 35 feet long. Net mesh size determines which birds can be caught and overlapping "pockets" in the net cause birds to entangle themselves when they fly into the net.

Cannon nets are normally used for larger birds such as pigeons, feral ducks, and waterfowl and use mortar projectiles to propel a net up and over birds which have been baited to a particular site. This type of net is especially effective for waterfowl that are flightless due to molting and other birds which are typically shy to other types of capture.

Swedish Goshawk traps are large cage type traps used for catching large birds of prey such as hawks and owls. These traps are two part traps with live bait (pigeons, rabbits, or starlings) placed in the lower section. The birds of prey are captured, when then investigate the prey and perch on the trigger bar causing them to fall into the upper portions of the trap, which closes around the bird.

Bal-chatri traps are small traps used for capturing birds of prey such as hawks and owls. Live bait such as pigeons, starlings, rodents, etc. are used to lure raptors into landing on the trap (Hygnstrom and Craven 1994) where nylon nooses entangle their feet and hold the bird. The trap is made of chicken wire or other wire mesh material which is formed into a Quonset hut-shaped cage that holds the live bait. The outside top and sides are covered with many nooses consisting of strong monofilament line or stiff nylon string.

Leghold traps are traps that come in a variety of sizes that allows the traps to be species specific of some degree. These traps are used for both mammals and birds and can be set on land or in water. The traps are made of steel with springs to close the trap around the foot and leg of the target species. These traps may have steel or padded bars, which hold the animal.

Cage traps are live capture traps used to trap a variety of small to medium sized mammals. Cage traps come in a variety of sizes and are made of galvanized wire mesh, and consists of a treadle in the middle of the cage that triggers the door to close behind the animal being trapped.

Sherman box traps are small live traps used to capture small mammals such as rodents. These traps are often made of galvanized steel or aluminum and fold up for easy transport. Sherman box traps also consist of a treadle towards the back of the trap that triggers the door to close behind the animal being trapped.

Snares are traps made of light cable with a locking device, and are used to catch small and medium sized mammals. The cable is placed in the path of an animal in the form of a loop. When the target species walks into the snare the loop becomes smaller in size, holding the animal as if it were on a leash. Many snares are equipped with integrated stops that permit snaring, but do not choke the animal.

Bow nets are small circular net traps used for capturing birds and small mammals. The nets are hinged and spring loaded so that when the trap is set it resembles a half moon. The net is set over a food source and it triggered by an observer using a pull cord.

Hand nets are used to catch birds and small mammals in confined areas such as homes and businesses. These nets resemble fishing dip nets with the exception that they are larger and have long handles.

Net guns are devices used to trap birds and mammals. The devices project a net over at target using a specialized gun.

NONLETHAL METHODS - CHEMICAL

Egg oiling is method of suppressing reproduction of nuisance birds by spraying a small quantity of mineral oil or food grade corn oil on eggs in nests. The oil prevents exchange of gases and causes asphyxiation of developing embryos and has been found to be 96-100% effective in reducing hatchability. (Pochop 1998; Pochop et al. 1998). The method has an advantage over nest or egg destruction in that the incubating birds generally continue incubation and do not re-nest. The EPA has ruled that use of corn oil for this purpose is exempt from registration requirements under FIFRA. To be most effective, the oil should be applied anytime between the fifth day after the laying of the last egg in a nest and at least five days before anticipated hatching. This method is extremely target specific and is less labor intensive than egg addling.

Methyl anthranilate (artificial grape flavoring used in foods and soft drinks for human consumption) could be used or recommended by WS as a bird repellent. Methyl anthranilate (MA) (artificial grape flavoring food additive) has been shown to be an effective repellent for many bird species, including waterfowl (Dolbeer et al. 1993). Methyl anthranilate (MA) is also under investigation as a potential bird taste repellent. MA may become available for use as a livestock feed additive (Mason et.al. 1984; 1989). It is registered for applications to turf or to surface water

areas used by unwanted birds. The material has been shown to be nontoxic to bees (LD_{50} > 25 micrograms/bee[3]), nontoxic to rats in an inhalation study (LC_{50} > 2.8 mg/L[i]), and of relatively low toxicity to fish and other invertebrates. Methyl anthranilate is naturally occurring in concord grapes and in the blossoms of several species of flowers and is used as a food additive and perfume ingredient (Dolbeer et al. 1992; RJ Advantage, Inc. 1997). It has been listed as "Generally Recognized as Safe" (GRAS) by the U.S. Food and Drug Administration (Dolbeer et al. 1992).

Water surface and turf applications of MA are generally considered expensive. For example, the least intensive application rate required by label directions is 20 lbs. of product (8 lbs. active ingredient) per acre of surface water at a cost of about $64/lb. with retreating required every 3-4 weeks (RJ Advantage, Inc. 1997). An example of the level of expense involved is a golf course in Rio Rancho, NM where it was estimated that treating four watercourse areas would cost in excess of $25,000 per treatment for material alone. Cost of treating turf areas would be similar on a per acre basis. Also, MA completely degrades in about 3 days when applied to water (RJ Advantage, Inc. 1997) which indicates the repellent effect is short-lived.

Another potentially more cost effective method of MA application is by use of a fog-producing machine (Vogt 1997). The fog drifts over the area to be treated and is irritating to the birds while being non-irritating to any humans that might be exposed. Fogging applications must generally be repeated 3-5 times after the initial treatment before the birds abandon a treatment site (Dr. P. Vogt, RJ Advantage, Inc., pers. comm. 1997). Applied at a rate of about .25 lb./ acre of water surface, the cost is considerably less than when using the turf or water treatment methods.

MA is also being investigated as a livestock feed additive to reduce or prevent feed consumption by birds. Such chemicals undergo rigorous testing and research to prove safety, effectiveness, and low environmental risks before they would be registered by U.S. Environmental Protection Agency (EPA) or the Food and Drug Administration (FDA).

Other chemical repellents. A number of other chemicals have shown bird repellent capabilities. Anthraquinone, a naturally occurring chemical found in many plant species and in some invertebrates as a natural predator defense mechanism, has shown effectiveness in protecting rice seed from red-winged blackbirds and boat-tailed grackles (Avery et al. 1997). It has also shown effectiveness as a foraging repellent against Canada goose grazing on turf and as a seed repellent against brown-headed cowbirds (Dolbeer et al. 1998). This chemical is not yet registered in the U.S. but may become available at some future date. Compounds extracted from common spices used in cooking and applied to perches in cage tests have been shown repellent characteristics against roosting starlings (Clark 1997). Napthalene (moth balls) was found to be ineffective in repelling starlings (Dolbeer et al. 1998).

Tactile repellents. A number of tactile repellent products are on the market, which reportedly deter birds from roosting on certain structural surfaces by presenting a tacky or sticky surface that the birds avoid. However, experimental data in support of this claim are sparse (Mason and Clark 1989). The repellancy of tactile products is generally short-lived because of dust, and they sometimes cause aesthetic problems and expensive clean-up costs by running down the sides of buildings in hot weather.

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Avitrol® is a chemical frightening agent (repellent) that is effective in a single dose when mixed with untreated baits, normally in a 1:9 ratio. Avitrol®, however, is not completely non-lethal because a small portion of the birds are generally killed (Johnson and Glahn 1994). Pre-baiting is usually necessary to achieve effective bait acceptance by the target species. This chemical is registered for use on pigeons, crows, gulls, blackbirds, starlings, and English sparrows in various situations. Avitrol® treated bait is placed in an area where the targeted birds are feeding and usually a few birds will consume a treated bait and become affected by the chemical. The affected birds then broadcast distress vocalizations and display abnormal flying behavior, thereby frightening the remaining flock away.

Avitrol® is a restricted use pesticide that can only be sold to certified applicators and is available in several bait formulations where only a small portion of the individual grains carry the chemical. It can be used during anytime

[3] An LD_{50} is the dosage in milligrams of material per kilogram of body weight, or, in this case in micrograms per individual bee, required to cause death in 50% of a test population of a species.

of the year, but is used most often during winter and spring. Any granivorous bird associated with the target species could be affected by Avitrol®. Avitrol® is water soluble, but laboratory studies demonstrated that Avitrol® is strongly absorbed onto soil colloids and has moderately low mobility. Bio-degradation is expected to be slow in soil and water, with a half-life ranging from three to 22 months. However, Avitrol® may form covalent bonds with humic materials, which may serve to reduce its availability for intake by organisms from water, is non-accumulative in tissues and rapidly metabolized by many species (Schafer 1991).

Avitrol® is acutely toxic to avian and mammalian species, however, blackbirds are more sensitive to the chemical and there is little evidence of chronic toxicity. Laboratory studies with predator and scavenger species have shown minimal potential for secondary poisoning, and during field use only magpies and crows appear to have been affected (Schafer 1991). However, a laboratory study by Schafer et al. (1974) showed that magpies exposed to two to 3.2 times the published Lethal Dose (LD_{50})[4] in contaminated prey for 20 days, were not adversely affected and three American kestrels that were fed contaminated blackbirds for seven to 45 days were not adversely affected. A formal Risk Assessment found no probable risk is expected for pets and the public, based on low concentrations and low hazards quotient value for non-target indicator species tested on this compound (USDA 1997, Appendix P).

Alpha-chloralose is a central nervous system depressant used as an immobilizing agent to capture and remove nuisance waterfowl and other birds. It is labor intensive and in some cases, may not be cost effective (Wright 1973, Feare et al. 1981), but is typically used in recreational and residential areas, such as swimming pools, shoreline residential areas, golf courses, or resorts. Alpha-chloralose is typically delivered as a well-contained bait in small quantities with minimal hazards to pets and humans; single bread or corn baits are fed directly to the target birds. WS personnel are present at the site of application during baiting to retrieve the immobilized birds. Unconsumed baits are removed from the site following each treatment. Alpha-chloralose was eliminated from more detailed analysis in USDA (1997) based on critical element screening, therefore, environmental fate properties of this compound were not rigorously assessed. However, the solubility and mobility are believed to be moderate and environmental persistence is believed to be low. Bio-accumulation in plants and animal tissue is believed to be low. Alpha-chloralose is used in other countries as an avian and mammalian toxicant. The compound is slowly metabolized, with recovery occurring a few hours after administration (Schafer 1991). The dose used for immobilization is designed to be about two to 30 times lower than the LD_{50}. Mammalian data indicate higher LD_{50} values than birds. Toxicity to aquatic organisms is unknown (Woronecki et al. 1990) but the compound is not generally soluble in water and therefore should remain unavailable to aquatic organisms. Factors supporting the determination of this low potential included the lack of exposure to pets, nontarget species and the public, and the low toxicity of the active ingredient. Other supporting rationale for this determination included relatively low total annual use and a limited number of potential exposure pathways. The agent is currently approved for use by WS as an Investigative New Animal Drug by the FDA rather than a pesticide.

LETHAL METHODS - MECHANICAL

Conibear (Body Gripping) Traps are the steel framed traps used to capture and quickly kill aquatic mammals. These traps come in a variety of sizes and may be used on land or in the water depending on size and state and local laws. The traps are made of two steel square frames that are hinged on two sides and have one or two springs.

Shooting is more effective as a dispersal technique than as a way to reduce bird densities when large numbers of birds are present. Normally shooting is conducted with shotguns or air rifles. Shooting is a very individual specific method and is normally used to remove a single offending bird. However, at times, a few birds could be shot from a flock to make the remainder of the birds more wary and to help reinforce non-lethal methods. Shooting can be relatively expensive because of the staff hours sometimes required (USDA 1997). It is selective for target species and may be used in conjunction with the use of spotlights, decoys, and calling. Shooting with shotguns, air rifles, or rim and center fire firearms is sometimes used to manage bird and mammal damage problems when lethal methods are determined to be appropriate. The birds and animals are killed as quickly and humanely as possible. WS follows all firearm safety precautions when conducting WDM activities and all laws and regulations governing the lawful use of firearms are strictly complied with.

[4] An LD_{50} is the dosage in milligrams of material per liter of air required to cause death in 50% of a test population of a species through inhalation.

Firearm use is very sensitive and a public concern because of safety issues relating to the public and misuse. To ensure safe use and awareness, WS employees who use firearms to conduct official duties are required to attend an approved firearms safety and use training program within 3 months of their appointment and a refresher course every 2 years afterwards (WS Directive 2.615). WS employees who carry firearms as a condition of employment, are required to sign a form certifying that they meet the criteria as stated in the *Lautenberg Amendment* which prohibits firearm possession by anyone who has been convicted of a misdemeanor crime of domestic violence.

Sport Hunting is sometimes recommended by WS as a viable damage management method when the target species can be legally hunted, and activities can meet airport security and safety compliance. A valid hunting license and other licenses or permits may be required by the MDNR and USFWS for certain species. This method provides sport and food for hunters and requires no cost to the landowner. Sport hunting is occasionally recommended if it can be conducted safely for pigeon damage management white-tailed deer, Canada geese, and other damage causing waterfowl.

Snap traps are used to remove small rodents and may be modified to remove individual woodpeckers, starlings, and other cavity use birds. The trap treadle is baited with peanut butter or other taste attractants and attached near the damage area. These traps pose no imminent danger to pets or the public.

Cervical Dislocation is sometimes used to euthanize small rodents and birds which are captured in live traps and when relocation is not a feasible option. The bird is stretched and the neck is hyper-extended and dorsally twisted to separate the first cervical vertebrae from the skull. The AVMA approves this technique as humane method of euthanasia and states that cervical dislocation when properly executed is a humane technique for euthanasia of small rodents, poultry and other small birds (Beaver et al 2001).. Cervical dislocation is a technique that may induce rapid unconsciousness, does not chemically contaminate tissue, and is rapidly accomplished (Beaver et al 2001).

LETHAL METHODS - CHEMICAL

All chemicals used by WS are registered as required by the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) (administered by the EPA and the MDA) or by the FDA. WS personnel that use restricted-use chemical methods are certified as pesticide applicators by MDA and are required to adhere to all certification requirements set forth in FIFRA and Maryland pesticide control laws and regulations. Chemicals are only used on private, public, or tribal property sites with authorization from the property owner/manager.

CO2 is sometimes used to euthanize birds which are captured in live traps and when relocation is not a feasible option. Live birds are placed in a container such as a plastic 5-gallon bucket or chamber and sealed shut. CO2 gas is released into the bucket or chamber and birds quickly die after inhaling the gas. This method is approved as a euthanizing agent by the American Veterinary Medical Association. CO_2 gas is a byproduct of animal respiration, is common in the atmosphere, and is required by plants for photosynthesis. It is used to carbonate beverages for human consumption and is also the gas released by dry ice. The use of CO_2 by WS for euthanasia purposes is exceedingly minor and inconsequential to the amounts used for other purposes by society.

Gas Cartridge is registered as a fumigant by the EPA. When ignited, the cartridge burns in the den of an animal and produces large amounts of carbon monoxide, a colorless, odorless, and tasteless, poisonous gas. The combination of oxygen depletion and carbon monoxide exposure kills the animals in the den. Carbon monoxide euthanasia is recognized by the AVMA as an approved and humane method to euthanize animals (Beaver et al. 2001). CO_2 gas is a byproduct of animal respiration, is common in the atmosphere, and is required by plants for photosynthesis. It is used to carbonate beverages for human consumption and is also the gas released by dry ice. The use of CO_2 by WS for euthanasia purposes is exceedingly minor and inconsequential to the amounts used for other purposes by society.

DRC-1339 is the principal chemical method that would be used for starling/blackbird and pigeon damage management in the proposed action. For more than 30 years, DRC-1339 has proven to be an effective method of starling, blackbird, gull, and pigeon control at feedlots, dairies, airports, and in urban areas (West et al. 1967, Besser et al. 1967, Decino et al. 1966). Studies continue to document the effectiveness of DRC-1339 in resolving blackbird

starling problems at feedlots (West and Besser 1976, Glahn 1982, Glahn et al. 1987), and Blanton et al. (1992) reports that DRC-1339 appears to be a very effective, selective, and safe means of urban pigeon population reduction. Glahn and Wilson (1992) noted that baiting with DRC-1339 is a cost-effective method of reducing damage by blackbirds to sprouting rice.

DRC-1339 is a slow acting avicide that is registered with the EPA for reducing damage from several species of birds, including blackbirds, starlings, pigeons, crows, ravens, magpies, and gulls. DRC-1339 was developed as an avicide because of its differential toxicity to mammals. DRC-1339 is highly toxic to sensitive species but only slightly toxic to nonsensitive birds, predatory birds, and mammals. For example, starlings, a highly sensitive species, require a dose of only 0.3 mg/bird to cause death (Royall et al. 1967). Most bird species that are responsible for damage, including starlings, blackbirds, pigeons, crows, magpies, and ravens are highly sensitive to DRC-1339. Many other bird species such as raptors, sparrows, and eagles are classified as nonsensitive. Numerous studies show that DRC-1339 poses minimal risk of primary poisoning to nontarget and T&E species (USDA 1997). Secondary poisoning has not been observed with DRC-1339 treated baits. During research studies, carcasses of birds which died from DRC-1339 were fed to raptors and scavenger mammals for 30 to 200 days with no symptoms of secondary poisoning observed (Cunningham et al. 1981). This can be attributed to relatively low toxicity to species that might scavenge on blackbirds and starlings killed by DRC-1339 and its tendency to be almost completely metabolized in the target birds which leaves little residue to be ingested by scavengers. Secondary hazards of DRC-1339 are almost nonexistent. DRC-1339 acts in a humane manner producing a quiet and apparently painless death.

DRC-1339 is unstable in the environment and degrades rapidly when exposed to sunlight, heat, or ultra violet radiation. DRC-1339 is highly soluble in water but does not hydrolyze and degradation occurs rapidly in water. DRC-1339 tightly binds to soil and has low mobility. The half life is about 25 hours, which means it is nearly 100% broken down within a week, and identified metabolites (i.e., degradation chemicals) have low toxicity. Aquatic and invertebrate toxicity is low (USDA 1997). Appendix P of USDA (1997) contains a thorough risk assessment of DRC-1339 and the reader is referred to that source for a more complete discussion. That assessment concluded that no adverse effects are expected from use of DRC-1339.

DRC-1339 has several EPA Registration Labels (56228-10, 56228-17, 56228-28, 56228-29, and 56228-30) depending on the application or species involved in the BDM project.

Zinc Phosphide, at concentrations of 0.75% to 2.0% on grain, fruit, or vegetable baits, has been used successfully against such species as meadow mice, ground squirrels, prairie dogs, Norway rats, Polynesian rats, cotton rats and nutria. Zinc phosphide is a heavy, finely ground gray-black powder that is partially insoluble in water and alcohol. When exposed to moisture, it decomposes slowly and releases phosphine gas (PH3) Phospine, which s highly flammable, may be generated rapidly if the material comes in contact with dilute acids. Zinc phosphide concentrate is a stable material when kept dry and hermetically sealed.

Although zinc phosphate baits have a strong, pungent, phosphorous-like odor (garlic like), this characteristic seems to attract rodents, particularly rats, and apparently makes the bait unattractive to some other animals. For many uses of zinc phosphate formulated on grain or grain-based baits, pre-baiting is recommended or necessary for achieving good bait acceptance.

When zinc phosphate comes into contact with dilute acids in the stomach, phosphate (PH3) is released. It is this substance that probably caused death. Animals that ingest lethal amounts of bait usually succumb overnight with terminal symptoms of convulsions, paralysis, coma, and death from asphyxia. If death is prolonged for several days, intoxication that occurs is similar to intoxication with yellow phosphorous, in which the liver is heavily damaged. Prolonged exposure to phosphine can produce chronic phosphorous poisoning.

Because zinc phosphide is not stored in muscle or other tissues of poisoned animals, there is no secondary poisoning with this rodenticide. The bait however, remains toxic up to several days in the gut of the dead rodent. Other animals can be poisoned if they eat enough of the gut content of rodents recently killed with zinc phosphide.

Warfarin and Diphacinone. Several anticoagulant rodenticides are used to control commensal rodents and some field rodents around building and other structures. Common anticoagulants include warfarin and diphacinone.

Anticoagulants are normally classified s multiple-dose toxicants. For the materials to be effective, animals must feed on the bait more than once. However, some newer formulations only require a single feeding to e effective. Bair for rats and mice must be continuously available for 2 to 3 weeks for efffective population control.

APPENDIX D

Diseases transmittable to humans and livestock that are associated with feral domestic pigeons, starlings, and English sparrows

--Information taken from Weber (1979)

Disease	Human Symptoms	Potential for Human Fatality	Effects on Domestic Animals
Bacterial:			
Erysipeloid	Skin eruption with pain, itching; headaches, chills, joint pain, prostration, fever, vomiting	Sometimes-particularly in young children, old or infirm people	Serious hazard for the swine industry
Salmonellosis	Gastroenteritis, septicaemia, persistent infection	Possible, especially in individuals weakened by other disease or old age	Causes abortions in mature cattle, possible mortality in calves, decrease in milk production in dairy cattle
Pasteurellosis	Respiratory infection, nasal discharge, conjunctivitis, bronchitis, pneumonia, appendicitis, urinary bladder inflammation, abscessed wound infections	Rarely	May fatally affect chickens, turkeys, and other fowl
Listeriosis	Conjunctivitis, skin infections, meningitis in newborns, abortions, premature delivery, stillbirth	Sometimes-particularly with newborns	In cattle, sheep, and goats, difficulty swallowing, nasal discharge, paralysis of throat and facial muscles
Viral:			
Meningitis	Inflammation of membranes, covering the brain, dizziness, and nervous movements	Possible-can also result as a secondary infection with listeriosis, salmonellosis, cryptococcosis	Causes middle ear infection in swine, dogs, and cats
Encephalitis (7 forms)	Headache, fever, stiff neck, vomiting, nausea, drowsiness, disorientation	Mortality rate for eastern equine encephalomyelitis may be around 60%	May cause mental retardation, convulsions, and paralysis
Mycotic (fungal):			
Aspergillosis	Affects lungs and broken skin, toxins poison blood, nerves, and body cells	Not usually	Causes abortions in cattle
Blastomycosis	Weight loss, fever, cough, bloody sputum and chest pains	Rarely	Affects horses, dogs, and cats
Candidiasis	Infection of skin, fingernails, mouth,	Rarely	Causes mastitis, diarrhea, vaginal discharge and aborted fetuses in cattle

Disease	Human Symptoms	Potential for Human Fatality	Effects on Domestic Animals
	respiratory system, intestines, and urogenital tract		
Cryptococcosis	Lung infection, cough, chest pain, weight loss, fever or dizziness, also causes meningitis	Possible especially with meningitis	Chronic mastitis in cattle, decreased milk flow, and appetite loss
Histoplasmosis	Pulmonary or respiratory disease; may affect vision	Possible, especially in infants and young children or if disease disseminates to the blood and bone marrow	Actively grows and multiplies in soil and remains active long after birds have departed
Protozoal:			
American trypanosomiasis	Infection of mucous membranes of eyes or nose, swelling	Possible death in 2-4 weeks	Caused by the conenose bug found in pigeons
Toxoplasmosis	Inflammation of the retina, headaches, fever, drowsiness, pneumonia, strabismus, blindness, hydrocephalus, epilepsy, and deafness	Possible	May cause abortion or still birth in humans, mental retardation
Rickettsial/Chlamydial:			
Chlamydiosis	Pneumonia, flu-like respiratory infection, high fever, chills, loss of appetite, cough, severe headaches, generalized aches and pains, vomiting, diarrhea, hepatitis, insomnia, restlessness, low pulse rate	Occasionally, restricted to old, weak or those with concurrent diseases	In cattle, may result in abortion, arthritis, conjunctivitis, and enteritis
Q fever	Sudden pneumonitis, chills, fever, weakness, sever sweating, chest pain, severe headaches, and sore eyes	Possible	May cause abortions in sheep and goats

Appendix E

Current and Historical Rare, Threatened, and Endangered Species of Anne Arundel County, Maryland*

July 5, 2001

Maryland Department of Natural Resources
Wildlife and Heritage Division

Scientific name	Common Name	Global Rank	State Rank	State Status	Federal Status
ANIMALS					
Ambystoma tigrinum	Eastern tiger salamander	G5	S2	E	
Autochton cellus	Golden-banded skipper	G4	S1	E	
Etheostoma vitreum	Glassy darter	G4G5	S1S2	E	
Falco peregrinus	Peregrine falcon	G4	S1B	E	
Fundulus luciae	Spotfin killifish	G4	S2?		
Gallinula chloropus	Common moorhen	G5	S2B	I	
Graptemys geographica	Map turtle	G5	S1	E*	
Haliaeetus leucocephalus	Bald eagle	G4	S2S3B	T	LT
Hydrochara occulta	A hydrophilid beetle	G?	SU		
Laterallus jamaicensis	Black rail	G4	S2S3B	I	
Meropleon titan	A noctuid moth	G2G4	SU		
Nerodia erythrogaster erythrogaster	Redbelly water snake	G5T5	S2S3		
Percina notogramma	Stripeback darter	G4	S1	E	
Pituophis melanoleucus	Northern pine snake	G4	SR		
Podilymbus podiceps	Pied-billed grebe	G5	S2B		
Porzana carolina	Sora	G5	S1B		
Sperchopsis tessellatus	A hydrophilid beetle	G?	S2		
Sterna antillarum	Least tern	G4	S2B	T	
Stygobromus indentatus	Tidewater amphipod	G3	S1		
PLANTS					
Aeschynomene virginica	Sensitive joint-vetch	G2	S1	E	LT
Agalinis setacea	Thread-leaved gerardia	G5?	S1	E	
Agrimonia microcarpa	Small-fruited agrimony	G5	SU		
Agrimonia striata	Woodland agrimony	G5	S1	E	
Antennaria solitaria	Single-headed pussytoes	G5	S2	T	
Arabis shortii	Short's rockcress	G5	S2	T	
Aristida curtissii	Curtiss' three-awn	G5T5	SU		
Aristida lanosa	Woolly three-awn	G5	S1	E	
Arundinaria gigantea	Giant cane	G5	S2		
Aster concolor	Silvery aster	G4?	S1	E	
Aster nemoralis	Bog aster	G5	SE?		
Aster praealtus	Willow aster	G5	S1		
Azolla caroliniana	Mosquito fern	G5	SU		
Bidens mitis	Small-fruited beggar-ticks	G4?	S1	E	
Calopogon tuberosus	Grass-pink	G5	S1	E	

Scientific name	Common Name	Global Rank	State Rank	State Status	Federal Status
Carex exilis	Coast sedge	G5	S1	E	
Carex hyalinolepis	Shoreline sedge	G4G5	S2S3		
Carex lupuliformis	Hop-like sedge	G4	S1?		
Carex vesicaria	Inflated sedge	G5	S1	T	
Carex vestita	Velvety sedge	G5	S1	E	
Castanea dentata	American chestnut	G4	S2S3		
Chamaedaphne calyculata	Leatherleaf	G5	S1	T	
Chelone obliqua	Red turtlehead	G4	S1	T	
Corallorhiza wisteriana	Wister's coralroot	G5	S1	E	
Cuscuta coryli	Hazel dodder	G5	SH	X	
Cuscuta indecora	Pretty dodder	G5	SH		
Cuscuta polygonorum	Smartweed dodder	G5	S1	E	
Cyperus retrofractus	Rough cyperus	G5	S2		
Desmodium humifusum	Trailing tick-trefoil	G5	S1	E	
Desmodium pauciflorum	Few-flowered tick-trefoil	G5	S1	E	
Desmodium strictum	Stiff tick-trefoil	G4	S1	E	
Diplazium pycnocarpon	Glade fern	G5	S2	T	
Eleocharis albida	White spikerush	G4G5	S1	E	
Eleocharis flavescens	Pale spikerush	G5	S1		
Eleocharis halophila	Salt-marsh spikerush	G4	S1	E	
Eleocharis intermedia	Matted spikerush	G5	S1	E	
Eleocharis rostellata	Beaked spikerush	G5	S2?		
Eriocaulon aquaticum	Seven-angled pipewort	G5	S1	E	
Festuca paradoxa	Cluster fescue	G5	SH	X	
Fraxinus profunda	Pumpkin ash	G4	S2S3		
Galium hispidulum	Coast bedstraw	G5	S1	E	
Gaylussacia brachycera	Box huckleberry	G3	S1	E	
Gentiana villosa	Striped gentian	G4	S1	E	
Geum aleppicum	Yellow avens	G5	S1	E	
Gymnocladus dioicus	Kentucky coffee-tree	G5	S1		
Helianthemum bicknellii	Hoary frostweed	G5	S1	E	
Helonias bullata	Swamp pink	G3	S2	E	LT
Hexalectris spicata	Crested coralroot	G5	SH	X	
Iris verna	Dwarf iris	G5	S1	E	
Juncus caesariensis	New Jersey rush	G2	S1	E	
Juncus pelocarpus	Brown-fruited rush	G5	S1	E	
Krigia dandelion	Potato dandelion	G5	S1	E	
Lechea tenuifolia	Narrow-leaved pinweed	G5	SH	X	
Leptochloa fascicularis	Long-awned diplachne	G5	SU		
Lupinus perennis	Wild lupine	G5	S2	T	
Lygodium palmatum	Climbing fern	G4	S2	T	
Matelea carolinensis	Anglepod	G4	S1	E	
Matelea obliqua	Climbing milkweed	G4?	S1	E	
Monotropsis odorata	Sweet pinesap	G3	S1	E	
Najas gracillima	Thread-like naiad	G5?	SU	X	
Nymphoides aquatica	Larger floating-heart	G5	S1	E	
Orthilia secunda	One-sided pyrola	G5	SH	X	
Panicum leucothrix	Roughish panicgrass	G4?Q	SU		
Platanthera blephariglottis	White fringed orchid	G4G5	S2	T	
Platanthera cristata	Crested yellow orchid	G5	S2	T	
Platanthera flava	Pale green orchid	G2	S2		
Pluchea camphorata	Marsh fleabane	G5	S1	E	
Polanisia dodecandra	Clammyweed	G5	S1	E	

Scientific name	Common Name	Global Rank	State Rank	State Status	Federal Status
Polygonum densiflorum	Dense-flowered knotweed	G5	S1?	E	
Polygonum ramosissimum	Bushy knotweed	G5	SH	X	
Polygonum robustius	Stout smartweed	G4G5	SH	X	
Potamogeton perfoliatus	Clasping-leaved pondweed	G5	S2		
Potamogeton richardsonii	Redheadgrass	G5	SH	X	
Potamogeton spirillus	Spiral pondweed	G5	S1		
Prunus maritima	Beach plum	G4	S1	E	
Ranunculus ambigens	Water-plantain spearwort	G4	SH	X	
Rhynchosia tomentosa	Hairy snoutbean	G5	S2	T	
Rhynchospora cephalantha	Capitate beakrush	G5	S1	E	
Rhynchospora globularis	Grass-like beakrush	G5	S1	E	
Rhynchospora glomerata	Clustered beakrush	G5	S2	T	
Sagittaria calycina	Spongy lophotocarpus	G5	S2		
Salix tristis	Dwarf prairie willow	G4G5	S1		
Sarracenia purpurea	Northern pitcher-plant	G5	S2	T	
Schwalbea americana	Chaffseed	G2	SX	X	LE
Scirpus smithii	Smith's clubrush	G5?	SU	X	
Scirpus subterminalis	Water clubrush	G4G5	S1	E	
Scleria triglomerata	Tall nutrush	G5	S1S2		
Silene nivea	Snowy campion	G4?	S1	E	
Smilax pseudochina	Halberd-leaved greenbrier	G4G5	S2	T	
Solidago hispida	Hairy goldenrod	G5	SH	X	
Solidago rigida	Hard-leaved goldenrod	G5	SH	X	
Solidago speciosa	Showy goldenrod	G5	S2	T	
Sporobolus asper	Long-leaved rushgrass	G5	S1		
Stachys hyssopifolia	Hyssop-leaved hedge-nettle	G5	SU		
Stenanthium gramineum	Featherbells	G4G5	S1	T	
Thelypteris simulata	Bog fern	G4G5	S2	T	
Tofieldia racemosa	Coastal false asphodel	G5	SX	X	
Torreyochloa pallida	Pale mannagrass	G5?	S1	E	
Trachelospermum difforme	Climbing dogbane	G4G5	S1	E	
Triadenum tubulosum	Large marsh St. John's-wort	G4?	S1		
Trichostema setaceum	Narrow-leaved bluecurls	G5	S1		
Triosteum angustifolium	Narrow-leaved horse-gentian	G5	S1	E	
Utricularia biflora	Two-flowered bladderwort	G5	S1	E	
Utricularia cornuta	Horned bladderwort	G5	SH		
Utricularia fibrosa	Fibrous bladderwort	G4G5	S1	E	
Viola septentrionalis	Northern blue violet	G5	SU		
Vitis cinerea	Graybark	G4G5	SU		
Xyris smalliana	Small's yelloweyed-grass	G5	S1	E	

* This report represents a compilation of information in the Wildlife and Heritage Division's Biological and Conservation Data system as of the date on this report. It does not include species considered to be "watch list" or more common species, except in cases where the species is currently State-listed (see State Status column). In these instances, the species is likely to be downgraded or removed from the State list in the near future. Please refer to the attachment for an explanation of the rank and status codes.

EXPLANATION OF GLOBAL AND STATE SPECIES RANKS

Originally developed and instituted by The Nature Conservancy, an international conservation organization, the global and state ranking system is used by all 50 State Natural Heritage Programs and numerous Conservation Data Centers in other countries in this hemisphere. Because they are assigned based upon standard criteria, the ranks can be used to assess the range-wide status of a species as well as the status within portions of the species' range. The

primary criterion used to define these ranks are the number of known distinct occurrences with consideration given to the total number of individuals at each locality. Additional factors considered include the current level of protection, the types and degree of threats, ecological vulnerability, and population trends. Global and state ranks are used in combination to set inventory, protection, and management priorities for species both at the State as well as regional level.

GLOBAL RANK

G1 Highly globally rare. Critically imperiled globally because of extreme rarity (typically 5 or fewer estimated occurrences or very few remaining individuals or acres) or because of some factor(s) making it especially vulnerable to extinction.
G2 Globally rare. Imperiled globally because of rarity (typically 6 to 20 estimated occurrences or few remaining individuals or acres) or because of some factor(s) making it very vulnerable to extinction throughout its range.
G3 Either very rare and local throughout its range or distributed locally (even abundantly at some of its locations) in a restricted range (e.g., a single western state, a physiographic region in the East) or because of other factors making it vulnerable to extinction throughout its range; typically with 21 to 100 estimated occurrences.
G4 Apparently secure globally, although it may be quite rare in parts of its range, especially at the periphery.
G5 Demonstrably secure globally, although it may be quite rare in parts of its range, especially at the periphery.
GH No known extant occurrences (i.e., formerly part of the established biota, with the expectation that it may be rediscovered).
GU Possibly in peril range-wide, but its status is uncertain; more information is needed.
GX Believed to be extinct throughout its range (e.g., passenger pigeon) with virtually no likelihood that it will be rediscovered.
G? The species has not yet been ranked.
_Q Species containing a "Q" in the rank indicates that the taxon is of questionable or uncertain taxonomic standing (i.e., some taxonomists regard it as a full species, while others treat it at an infraspecific level).
_T Ranks containing a "T" indicate that the infraspecific taxon is being ranked differently than the full species.

STATE RANK

S1 Highly State rare. Critically imperiled in Maryland because of extreme rarity (typically 5 or fewer estimated occurrences or very few remaining individuals or acres in the State) or because of some factor(s) making it especially vulnerable to extirpation. Species with this rank are actively tracked by the Wildlife and Heritage Division (WHD).
S2 State rare. Imperiled in Maryland because of rarity (typically 6 to 20 estimated occurrences or few remaining individuals or acres in the State) or because of some factor(s) making it vulnerable to becoming extirpated. Species with this rank are actively tracked by WHD.
S3 Watch List. Rare to uncommon with the number of occurrences typically in the range of 21 to 100 in Maryland. It may have fewer occurrences but with a large number of individuals in some populations, and it may be susceptible to large-scale disturbances. Species with this rank are not actively tracked by WHD.
S3.1 A "Watch List" species that is actively tracked by WHD because of the global significance of Maryland occurrences. For instance, a G3 S3 species is globally rare to uncommon, and although it may not be currently threatened with extirpation in Maryland, its occurrences in Maryland may be critical to the long term security of the species. Therefore, its status in the State is being monitored.
S4 Apparently secure in Maryland with typically more than 100 occurrences in the State or may have fewer occurrences if they contain large numbers of individuals. It is apparently secure under present conditions, although it may be restricted to only a portion of the State.
S5 Demonstrably secure in Maryland under present conditions.
SA Accidental or a vagrant in Maryland.
SE Established, but not native to Maryland; it may be native elsewhere in North America.
SH Historically known from Maryland, but not verified for an extended period (usually 20 or more years), with the expectation that it may be rediscovered.
SP Potentially occurring in Maryland or likely to have occurred in Maryland (but without persuasive documentation).

SR Reported from Maryland, but without persuasive documentation that would provide a basis for either accepting or rejecting the report (e.g., no voucher specimen exists).
SRF Reported falsely (in error) from Maryland, and the error may persist in the literature.
SU Possibly rare in Maryland, but of uncertain status for reasons including lack of historical records, low search effort, cryptic nature of the species, or concerns that the species may not be native to the State. Uncertainty spans a range of 4 or 5 ranks as defined above.
SX Believed to be extirpated in Maryland with virtually no chance of rediscovery.
S? The species has not yet been ranked.
S ? A question mark after another rank indicates uncertainty regarding that rank.

STATE STATUS
This is the status of a species as determined by the Maryland Department of Natural Resources, in accordance with the Nongame and Endangered Species Conservation Act. Definitions for the following categories have been taken from Code of Maryland Regulations (COMAR) 08.03.08.

E Endangered; a species whose continued existence as a viable component of the State's flora or fauna is determined to be in jeopardy.
I In Need of Conservation; an animal species whose population is limited or declining in the State such that it may become threatened in the foreseeable future if current trends or conditions persist.
T Threatened; a species of flora or fauna which appears likely, within the foreseeable future, to become endangered in the State.
X Endangered Extirpated; a species that was once a viable component of the flora or fauna of the State, but for which no naturally occurring populations are known to exist in the State.
* A qualifier denoting the species is listed in a limited geographic area only.

FEDERAL STATUS
This is the status of a species as determined by the U.S. Fish and Wildlife Service's Office of Endangered Species, in accordance with the Endangered Species Act. Definitions for the following categories have been modified from 50 CRF 17.

LE Taxa listed as endangered; in danger of extinction throughout all or a significant portion of their range.
LT Taxa listed as threatened; likely to become endangered within the foreseeable future throughout all or a significant portion of their range.
PE Taxa proposed to be listed as endangered.
PT Taxa proposed to be listed as threatened.
C Candidate taxa for listing for which the Service has on file enough substantial information on biological vulnerability and threat(s) to support proposals to list them as endangered or threatened.

Appendix F

List of Consulting People, Reviewers and Preparers

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